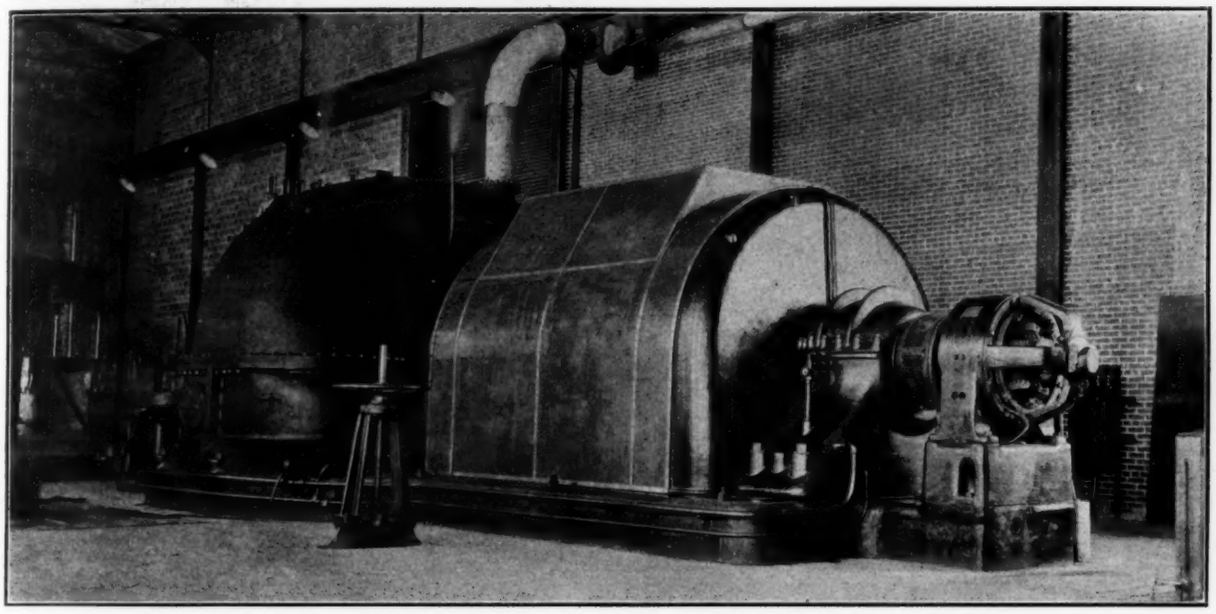
Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

Vol. 72—No. 8. CHICAGO, SATURDAY, FEBRUARY 23, 1918. Page 325.



The First Turbogenerator in Walnut Station. Rating 18,750 Kilovolt-Amperes. Direct-Connected Exciter at Right End of Generator. Large Valve in Foreground Controls Discharge From Condenser.

Walnut Station of Columbus Railway, Power & Light Company

Description of the New Steam-Electric Generating Station Located Ten Miles from Columbus, Ohio

THE Columbus Railway, Power & Light Company, as its name might indicate, operates the street cars and supplies light and power for the city of Columbus, Ohio, and its surrounding suburbs and nearby villages. The company has quite a number of old power stations, some of which are becoming inoperative due to one reason or another. It still owns the site and buildings that were used for the first commercial generating station built in Columbus, and the first Edison station started nearly thirty years ago is still in operating condition and used considerably at times. For a number of years the company has had plans under consideration for new power-plant equipment, and in the last two years this problem became extremely urgent due to the large increase in the industrial load and also due to the necessity of securing more economical operation.

The growth of the company has been very rapid during the last few years, due to the fact that the city has had a very healthy growth along industrial lines. From a small beginning when electricity was used principally for the operation of street cars and for lighting purposes, electrical energy is now in demand for the most varied purposes and is necessary for practically all manufacturing plants.

The company furnishes power for the operation of a number of the steam railroad repair shops, for the operation of interurban cars within the city limits and to some extent to the interurbans outside of the city; in addition to this the company also furnishes light and power to all the villages within a radius of approximately fifteen miles from the center of the city, and the demand is such that the territory served could be greatly increased if the power were available. The company at the present time is also supplying considerable power to Camp Sherman, the National Army camp at Chillicothe, also to the cities of Chillicothe and Circleville located about fifty miles south of Columbus.

As is well known to electrical men, large central stations are necessary and highly beneficial to our large cities. In many cases it is being found desirable to locate the principal generating station outside of the city limits. Completion of the plant to be

described makes the first time that the city of Columbus has been served with electrical energy from an outside source. It would seem reasonable that at no distant day that city, as well as the majority of other cities, would receive practically all of its power from central stations located outside of the corporation limits, the exact location of the generating plants being determined by the natural resources of the country rather than by the thickness of population in any one place. This revolution in central-station practice has been brought about by the perfection of transmission equipment.

Site and General Layout of Plant.

Due to the scarcity and quality of water for condensing purposes, and also to the lack of space for coal storage, it was considered desirable to find a site for a new power station outside of the city. The site chosen is ten miles southeast of the center at a point where the Hocking Valley Railway crosses Big Walnut Creek. This site consists of 25 acres of rolling ground on the southeast bank of the creek, with the railroad running through about the center of the property. Big Walnut Creek is formed by three small streams, Walnut, Black Lick and Alum creeks, which come together about a mile above the site of this plant. There are approximately 500 square miles in the water shed of Big Walnut Creek above the plant site. There is a natural pool in the creek at the station varying in depth at low water from 15 to 20 feet.

The plant proper is located on the northeast half of the property, the low ground of this part being used for coal storage; the part southwest of the railroad will be used for houses for the operators and also for coal storage. It will be the policy of the company to carry sufficient coal in storage, when it can be obtained, to run the plant for three or four months at a time. The boiler room is parallel to the railroad, the turbine room is at right angles to it and approximately parallel to the creek.

The site for Walnut station was purchased in January, 1917. Active work began in April and the station began regular operation November 18, 1917. This very rapid construction was accomplished in spite of delays in nearly all shipments of equipment and in the midst of a very difficult labor market.

That part of the station now in operation consists principally of one 15,000-kilowatt turbogenerator unit and eight 440-horsepower water-tube boilers provided with underfeed stokers and economizers. The plans include a second turbo unit of a capacity of 10,000 kilowatts and eight additional boilers. This equipment is under order and it is expected that it will be ready for installation in the early part of 1918.

The plant is laid out with the idea of having all equipment that requires attention on the main floor level, elevation 740 feet above sea level, this applying to the switchboard, turbines, motors for driving circulating water pumps and hot-well pumps, controllers for all forced-draft, induced-draft and stoker drives, battery-charging set, etc. Therefore, there will be as small occasion as possible for the operators leaving the main floor.

Foundations and Building Construction.

The foundations for walls and equipment are supported on reinforced mats or footings which rest on hard river gravel or clay hard pan, the character of earth varying according to the elevation of the various foundations. Extensive soundings and test pits were driven to determine the nature of underlying earth previous to starting construction. A test pipe was also driven in the deepest portion of the excavation.

The main building is a steel-frame structure supported on a reinforced-concrete foundation. The

View of Turbine Room From Big Walnut Creek, Showing Ports of Intake and Discharge Tunnels, Tanks of Water-Purifying Plant, and Portion of 39,400-Volt Outdoor Bus Structure at Right.

turbine room as now completed for two turbines is 156 feet 6 inches in length and 44 feet 1 inch in width, and is provided with a 35-ton Case four-motor electric traveling crane having a rail height of 25 feet above the main floor. The turbine-room basement is 15 feet high from floor to floor except under condensers, where the height is 20 feet. The boiler room now completed is 174 feet in length and 60 feet in width, and will be 174 feet long and 96 feet 2 inches wide when completed for 16 boilers. The height under the lower chord of the roof trusses is 30 feet 6 inches. The basement under the boiler room is 10 feet 6 inches high from floor to floor.

The outside walls are built of hard-burned red brick and the partition and temporary end walls of turbine room are built of interlocking tile. Fenestra steel sash glazed with factory-ribbed glass are used throughout the building. Steel rolling doors are used for large doorways and steel panelled doors are used on all small doorways.

The roofs are supported by Fink trusses provided with monitors, ventilation being secured by opening sections of the steel sash by means of suitable window-operating mechanism. The roof for the boiler room consists of a concrete slab waterproofed with three-ply J-M asbestos felt laid in asphalt. The turbine-room roof is similar, except that a slab made up of a composition of gypsum and wood fiber is used. this construction being resorted to in order to avoid possibility of condensation forming on the under side of the roof. The concrete slabs for roof and floors are supported by asbestos-protected corrugated metal with reinforcing fabric. The slabs are flat in both cases, being 2¼ inches thick for the roof and 4 inches thick for the floor.

Coal and Ash Handling Equipment.

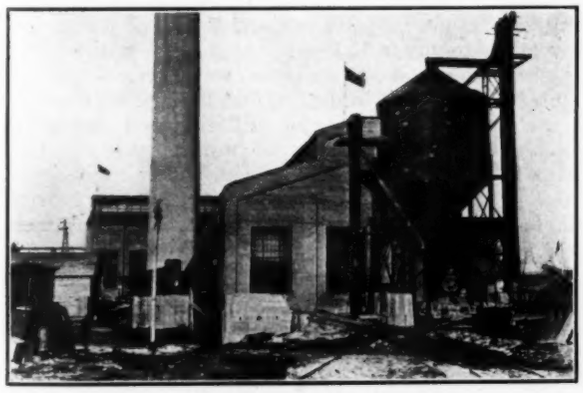
The equipment for handling coal and ashes is very complete. The station will be provided, when completed, with two 400-ton circular steel bunkers located over a track just outside of the boiler room at the southeast end of the station. Coal will be supplied to these bunkers from two track hoppers, the coal passing from these hoppers by means of a flight conveyor, through a single-roll coal crusher and thence by bucket elevator to the top of the coal bunkers. Each bunker has a conical bottom with clam-shell gate. The

coal from the bunkers will be carried into the boiler room by means of a 4½-ton electric traveling larry, which travels on a standard-gauge railroad track laid flush with the boiler-room floor. This larry has three 125-volt direct-current motors, one of which propels it on the track.

Track scales are provided immediately under one of the coal bunkers so that all coal can be accurately weighed as it is carried into the station. This arrangement will permit the keeping of accurate records of all coal used for the entire station or for any one boiler over any particular period. The larry is electrically operated, has a revolving bin which works like a turret, and is provided with screw conveyor which supplies the boilers on either side of the firing aisle. The larry requires only one man for its operation, is simple in construction and all wearing parts are very accessible for repairs.

The foundations for the boilers are of concrete and form the ash pits. Two drag-chain conveyors pass under each row of eight boilers, conveying the ashes out to the end of the station and discharging into a clinker crusher which in turn discharges into the boot of a bucket elevator. This elevator may discharge either into a concrete ash pit or railroad car or wagon. The ashes can be disposed of for a long time by grading around the property. Each drag-chain conveyor has sufficient capacity for carrying out the ashes and duplicate conveyors are furnished so as to allow repairs and changes to be made without inconvenience to operation, as arrangements are made so that either one can be isolated for repairs without interfering with the other. All of the coal and ash-handling equipment referred to, except the track scales, is being supplied by the Jeffrey Manufacturing Company, Columbus, Ohio.

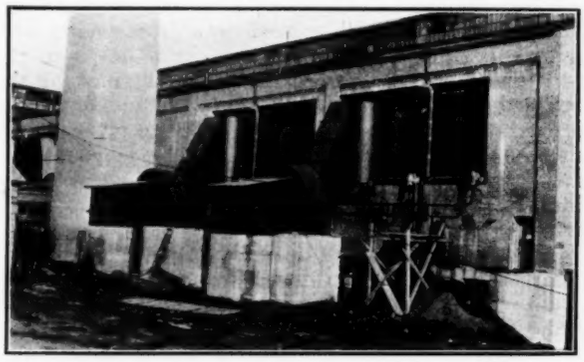
The two steel coal bunkers have capacity sufficient for one to two days' operation of the station. To provide against car shortage and irregularity of shipments an elevated storage track is provided, a track 480 feet in length being elevated approximately 15 feet over low ground in the northeast part of the station grounds. Since practically all the coal received is in hopper-bottom cars of one type or another, no labor will be required for unloading the cars. This track is supported by reinforced-concrete piers, 14-foot centers, and supported between piers by steel I-beams with steel cross members on 5-foot centers to prevent spreading. The coal will be distributed over the ground and reloaded into cars for moving into station by means of a 15-ton Brown Hoisting Machinery Company steam-driven locomotive crane, provided with 2-cubic-yard grab bucket and 48-foot boom.



View of Plant From Boiler-Room End, Showing the First Steel Coal Bin in Place. Extension of Boiler Room Will Be at Right. End of Turbine Room Shows Behind Concrete Stack at Left.

Boilers, Economizers and Other Boiler-Room Auxiliaries.

The boiler plant will consist of 16 Babcock & Wilcox cross-drum water-tube boilers, each having a heating surface of 4440 square feet. Each boiler has 21 sections of tubes, each section consisting of 10 tubes 18 feet long and 4 inches in diameter. Single-loop superheaters are also provided having 855 square feet heating surface which will give about 150 degrees superheat under average conditions. These boilers are designed for 250 pounds steam pressure and are provided with Diamond mechanical soot blowers, Copes feed-water regulators, Balanced-Draft regulators for automatically controlling the dampers according to the demand for steam, and with Bailey furnace meters which record the steam flow, the draft over and under the fuel bed, and the temperature of the exhaust gases.



Side of Boiler Room With Wall Openings for Economizers. Breeching, Induced-Draft Fans and Stack Are Outside of Building.

The boilers are set two in a battery and each boiler is provided with one eight-retort Sanford Riley self-dumping underfeed stoker, driven by a 20-horsepower back-geared General Electric induction motor. The gases from each battery of boilers pass through one Green Fuel economizer having 6300 square feet of heating surface, each economizer having 32 sections, and each section consisting of 12 tubes, 12 feet long, 4⅝ inches outside diameter. The economizers are provided with the usual scraper mechanism, and one 5-horsepower motor drives the scrapers on two economizers. The gases are conveyed from boiler to economizer by means of 5/16-inch-steel-plate flues covered with 1½ inches of asbestos. The gases from each economizer are in turn conveyed from the economizer by uncovered steel breechings outside the building to one 60,000-cubic-foot-per-minute Green induced-draft fan. These fans are direct-connected to 75-horsepower variable-speed inclosed Lincoln motors. The fans discharge downward into a concrete flue located below grade, which connects into the base of a tapered concrete chimney having a height of 150 feet and inside diameter at top of 14 feet 6 inches. Two of these chimneys will be provided, one at each side of the boiler room, one chimney accommodating four fans and eight boilers.

It should be noted that the boilers are arranged in units of two boilers, one economizer, two stokers, one forced-draft fan and one induced-draft fan, and

that no by-passes are provided for the economizer. It is expected to operate this unit continuously and when necessary to make extensive repairs to shut down the entire unit. Of course, either one of the boilers may be shut down for cleaning without disturbing the operation of the other. The stoker, forced-draft fan and induced-draft fan are all driven by motors, the controllers for which are located convenient to the boilers and are under the control of the boiler-room operators.

The Balanced-Draft equipment will provide the close regulation of the induced draft in harmony with changes in the forced draft; the large steps in the adjustment of the induced draft are obtained by the variable-speed motors, which are hand-controlled. The forced draft is also hand-regulated by varying the speed of the blower motors and by the movement of the dampers in the air supply ducts. Most of the forced-draft blowers are of Green make, but a few are of Sturtevant manufacture.

The economizers are operated in parallel and feed direct into the feed-water header, and to avoid unequal feeding from economizers there are Monel-metal orifices in the feed-water header between the connections to the economizers. As for the fine adjustment of the feed to the economizers, it is expected to obtain this by regulating the opening of the valves in the connections between the economizers and header, determining the adjustment of these valves by the temperature of the feed water leaving the economizers, as shown by Bristol recording thermometers. In addition to the Bailey recording furnace meters, there are Bristol recording thermometers for the gases leaving the economizers and for the water entering and leaving the economizers and also for the water entering the feed-water heater.

The condensate from the condensers is forced by Alberger centrifugal pumps to the top of the boiler room, where the water flows through Alberger-Hammond water meters into an open storage tank. This tank is divided into two compartments, one compartment with a capacity of 6000 gallons for condensate, and one compartment with a capacity of 3000 gallons for make-up water. The water from this storage tank flows through a Hoppes open feed-water heater having 1300 square feet of heating surface. The feed-water heater is divided into two parts; the condensate passes over one-third of the heating surface and the make-up water over two-thirds of the heating surface.

From this heater the water passes through a battery of four 400-gallon-per-minute four-stage Cameron centrifugal boiler-feed pumps, three of these pumps being driven by 100-horsepower induction motors at 1740 revolutions per minute, and the fourth by a Curtis steam turbine at 1850 revolutions per minute. The pumps will discharge direct into headers supplying the economizers, the latter carrying full boiler pressure plus the additional pressure required for forcing the water through the economizer to the boilers.

The steam from the boilers will be carried through 6-inch steam lines to a main 12-inch steam header. Each row of eight boilers will be provided with a 12-inch steam header, the two headers being connected together at each end so as to form a complete ring. In the same way the feed water will be supplied to the boilers from a 6-inch feed-water header for each row of boilers, and the feed-water headers will be connected across so as to form a complete loop.

For supplying the make-up water for boilers, that is, water over and above that secured from the surface condensers, a lime and soda-ash feed-water purifying plant is installed northwest of the turbine room. This plant consists principally of two 20,000-gallon wood-stave tanks with stirring mechanism, and an elevated dosing tank. The river water is of fairly good quality except during high water, when it may be quite roily.

A battery of four 200-gallon-per-minute motor-driven centrifugal pumps is located in the basement of the turbine room for furnishing water to the feed-water purification plant, for the cooling of bearings and for the 15,000-kilovolt-ampere transformers supplying the heavy outgoing lines.

Main Turbogenerators, Condensers and Condenser Auxiliaries.

The main unit is a General Electric unit of 18,750 kilovolt-amperes continuous rating and capable of carrying 18,750 kilowatts at unity power-factor. The turbine is of the Curtis horizontal type and has a water rate at full load, with 235 pounds steam pressure and 150 degrees superheat, of 11.35 pounds per kilowatt-hour. The unit has a speed of 1800 revolutions per minute. The generator is a 13,200-volt, three-phase, 60-cycle machine with direct-connected exciter at the end of the unit. The second unit to be installed will be similar, but smaller, having a rating of 12,500 kilovolt-amperes.

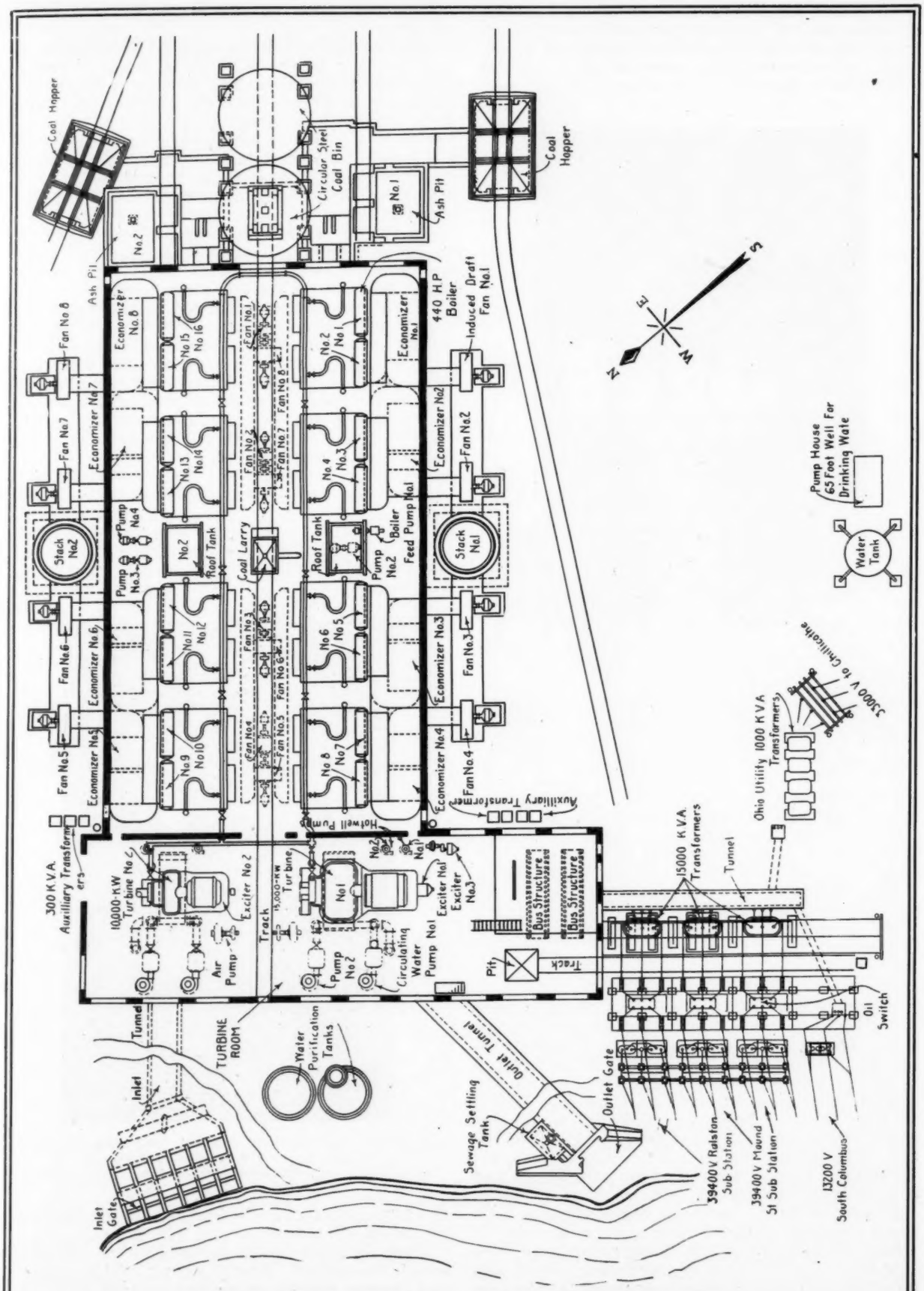
Each main turbine is provided with an Alberger surface condenser; for the larger unit this will have a cooling surface of 23,900 square feet.

The condenser of the larger turbo unit is bolted direct to the exhaust flange of the turbine without any expansion joint. Car springs are placed below the condenser and so compressed as to balance the weight of the empty condenser. These springs will allow the condenser to expand when heated and the turbine is capable of taking the additional weight of the water which may be in the condenser during regular operation.

Each condenser will be supplied with circulating water by duplicate vertical variable-speed motor-driven centrifugal pumps. These pumps receive water from a gravity tunnel which runs under the entire length of the turbine room and the water from the condensers discharges into an adjoining separate gravity tunnel, which also runs the full length of the turbine room and carries the water out into the river at a point about 160 feet below the intake. Each condenser is also provided with duplicate vertical motor-driven single-stage centrifugal condensate water pumps. Therefore, by the supplying of these duplicate sets of circulating water and hot-well pumps it is possible to avoid many reasons for shutdown. The vacuum pumps are of the Alberger centrifugal type and each is direct-connected to an Alberger-Curtis steam turbine.

The circulating water is carried into the station by a concrete intake tunnel and in turn is carried out by a similar discharge tunnel. This eliminates the usual large amount of piping required for circulating water, and also supplies the water at a convenient point with minimum waste of power. The water in the tunnel will have a velocity of about 2 feet per second with two turbines carrying full load, and about 3.1 feet per second with 40,000 kilowatts of turbine capacity in operation. The discharge water lines from the condensers are sealed in the discharge tunnel so that advantage is taken of the syphon action obtained thereby.

The intake end of the tunnel is enlarged and provided with a large area of racks (velocity through racks, 0.5 foot per second for the first two units, and 0.8 foot per second for 40,000 kilowatts of turbines



General Plan of Walnut Station, Showing Layout of Principal Equipment.

in operation) for the water to flow through. There are also provided six large removable wire baskets (1-inch mesh) which should catch nearly all leaves, twigs, etc., which may come down stream during high water. Each basket is in a separate compartment

Portion of 13,200-Volt Switch Cells With Potential Transformers at Top. Disconnecting Switches Are Just Back of Doors.

provided with a gate for shutting off the flow of water when the basket is raised for cleaning. A traveling hoist is provided for operating gates and baskets. Such particles of leaves, twigs, etc., as pass through these baskets and racks can be removed before reaching the condenser by means of Elliott twin strainers, with 3/8-inch holes, which are located between the circulating water pumps and the condensers. The circulating water pumps are located immediately on top of the intake tunnel so that a minimum suction lift of about 11 feet is secured. For the larger unit they are of 12,500 gallons per minute capacity and of R. D. Wood make. Each pump is driven by a 120-horsetions per minute.

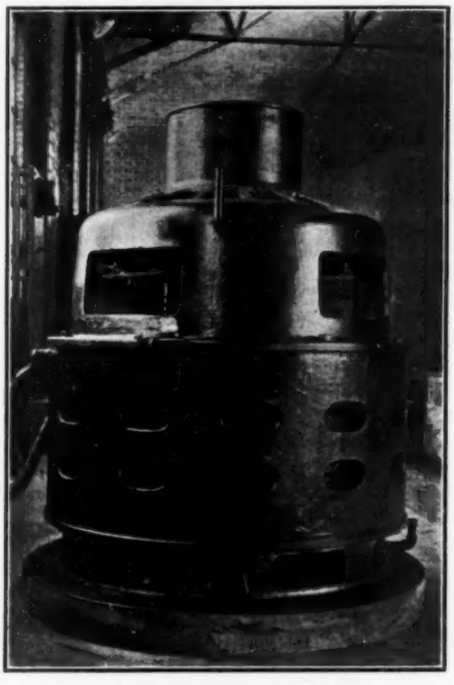
Electrical Features.

Since the station is located about 10 miles from the center of distribution of the current in Columbus, it was thought desirable to transmit at a higher voltage than that generated. Therefore, the current will be carried into the city over three transmission-line circuits at 39,400 volts, and one 13,200-volt circuit, the latter being the generating voltage, which will feed an industrial section at the extreme south end of the city. The electrical energy will be received at 39,400 volts at one point in the city at the present time and at second and third points later on. Current will be distributed in the city between substations and to large power customers at 13,200 volts; at the substations the voltage will be stepped down and the energy distributed over the 4150-volt four-wire distribution system supplying all other light and power customers. The tie lines between the principal substations of the city will operate at 13,200 volts and consist of triple-conductor lead-covered cables laid in vitrified-clay underground conduits.

The current will be transformed from 13,200 to 39,400 volts at the power station by means of 15,000-kilovolt-ampere, three-phase, 60-cycle, water-cooled, outdoor type General Electric transformers. Two units will be installed this year and a third transformer at a later date. All switches for the 13,200-volt primaries for these transformers and for the main generators will be located within the station, but all of the 39,400-volt switches, lightning arresters and connections will be located outside of the station. Provision is made for taking the transformers into the station on a truck so that they can be placed under the electric traveling crane for disassembly for any repairs and also for the original erection.

The generators are connected to the 13,200-volt bus through General Electric type H-3 oil switches and a transfer bus is provided with a transfer switch so that any 13,200-volt switch with its instrument transformers may be cut out of service and worked on when necessary without interrupting service. All feeders and other circuits are provided with the same type of oil switches and all of them are remote-controlled from the switchboard.

All of the auxiliaries in the station will be electrically operated with the exception of one boiler-feed pump, two dry vacuum pumps, and one turbo-exciter. The current for supplying these motor-driven auxiliaries will be supplied by two duplicate banks of three 300-kilovolt-ampere, single-phase, 13,200/220-volt outdoor type, self-cooled Wagner transformers.



Three-Phase Variable-Speed Vertical 120-Horsepower Motor Driving One of the Circulating Pumps in Turbine-Room Basement.

The total connected load of motors for auxiliaries in the station will amount to 2533 horsepower.

Each turbogenerator is provided with a direct-connected 100-kilowatt, 250-volt exciter, and a 100-kilowatt General Electric geared turbo-exciter set is provided for spare service; the latter operates at 3600 revolutions per minute.

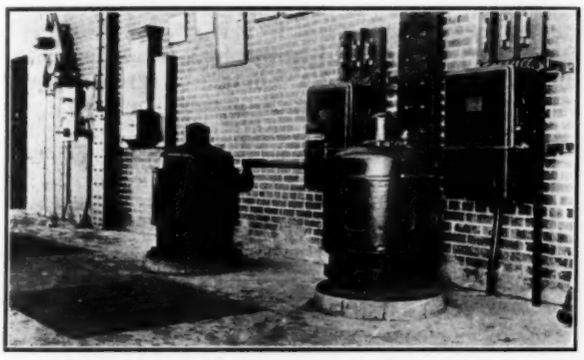
SUMMARY.

The notable features of this station are briefly summed up as follows:

This is the first station that has supplied electric power to Columbus from outside the city, up to this time all electric power having been generated by plants located within the city limits.

The boilers are of the Babcock & Wilcox cross-drum type, 10 tubes high, and carry 250 pounds pressure and are arranged with an economizer for two boilers, the economizer having approximately 71 per cent as much heating surface as two boilers. Each boiler being provided with one eight-retort Sanford Riley underfeed stoker, gives a unit which is capable of turning out a maximum of 340 per cent of its nominal rating, or, in other words, a battery of two boilers has a maximum capacity of 3000 horsepower, and the station may generate roughly 7 kilowatts per rated boiler horsepower.

Each economizer is arranged for two boilers without by-passes and with the access tubes and blow-off of the economizer on the outside of the building. The brick wall of the building is also omitted opposite the economizer and asbestos sectional covers are used for covering this side of the economizer. The removal of this covering allows the sections to be taken out for replacement. This arrangement is used to economize floor space and make the economizers easily inspected and repaired.



Three-Phase Vertical 35-Horsepower Motor Driving Condensate Pumps.

Switchboard Panels and 13,200-Volt Bus Structure. Pedestal at Right Controls Main Generator.

All the steam piping is provided with steel flanges and Vanstone joints, and welded nozzles are used wherever possible to eliminate joints and to make piping compact. All high-pressure steam valves are of Nelson cast-steel type with Monel-metal trimmings and are designed for 350 pounds pressure.

Complete coal and ash-handling equipment is provided, the coal being handled with minimum use of conveyors. The coal is discharged from the cars into a track hopper and all passes through a coal crusher, making the station independent as to size of coal which may be purchased. By means of the electric traveling larry the coal is delivered from the outside bunkers to stoker hoppers without the use of conveyors; this also provides a means of keeping accurate records of the weight of coal used.

Ashes are removed by the use of duplicate drag-chain conveyors, there being no labor required to deliver the ashes to the drag chains. A clinker crusher is provided so that the ash, whether fine or coarse, is automatically taken care of.

It is worth special mention that there is no reciprocating apparatus in the station, all equipment being rotating. There will be only four steam-driven auxiliaries, there being one turbine-driven feed pump, two turbine-driven dry vacuum pumps, and a turbine-driven emergency exciter. All other auxiliary equipment is driven by induction motors, the majority of which are arranged with variable-speed control. Also every motor or turbine has a flexible coupling, this including the generating units.

In providing spare equipment the idea has been to make each spare unit complete so that it can be regularly operated. For example, duplicate circulating pumps are provided, either one available for immediate service, the same being true of condensate pumps.

Very little space is required within the station for the electrical equipment. The control part is compact and only the 13,200-volt switches are within the station. All power transformers, high-voltage bus structure, main line switches and lightning arresters are located outdoors, but any of this equipment can be cut out of service and transported into the station for inspection and repairs, thus securing all the advantages of the outdoor type of electrical equipment with minimum disadvantages.

By means of the various meters, scales, recording instruments, etc., that are provided, it will be possible to keep an accurate record of the coal used, steam generated and the electrical output of the station, both net and gross, for any period of a day, for each day and for the entire month and year. This will allow the station records to be entirely complete with unit costs and with a minimum expenditure for complicated measuring instruments.

For the foregoing information and the accompanying illustrations we are indebted to the E. W. Clark & Co. Management Corporation, which designed and constructed this station.

Hydroelectric Development in Norway.—A new syndicate has been formed by Einar Steensrud, of Skien, for the consolidation and developing of a number of small waterfalls, aggregating 200,000 horsepower. The present intention is to utilize this power for the manufacture of nitrate, aluminum, or carbide, according as the demand develops. The annual report of the Norsk Hydro has appeared, covering the year ended June 30, 1917. The net profit was $6,650,000, compared with $4,900,000 in the previous year. The capital stock is $15,450,000. This company operates waterfalls of about 300,000 horsepower for the production of electrochemical commodities like nitrates and carbide. In the production of all of these commodities great heat is generated, and heretofore much of it has been wasted. By a new arrangement the waste heat is now to be utilized for the production of low-pressure steam to operate turbines.

NEW STATION OF DAYTON POWER & LIGHT COMPANY.

Preliminary Description of 25,000-Kilowatt Miller's Ford Plant.

By W. A. Scott.

The Dayton Power & Light Company's present operating power stations have a capacity of 22,500 kilowatts, and its new Miller's Ford power plant, which is nearing completion, will give the company additional capacity of 25,000 kilowatts. The new station is situated on the Miami River, three miles south of the business center of Dayton, Ohio, this location being the most advantageous on account of available water supply. The building is of steel frame, brick walls and concrete substructure. It occupies a ground space of 120 by 250 feet, with a height of 100 feet. The brick-lined steel stack, shown in the illustration, is 16 feet in diameter and 330 feet in height.

The boiler room affords space required for six 1400-horsepower boilers, the initial installation consisting of three Babcock & Wilcox cross-drum boilers of that size, each equipped with a Taylor 14-retort stokers. These boilers are designed for a working press of 225 pounds and 125 degrees superheat. The feed-water pumps and feed-water heaters were furnished by the Platt Iron Works. The surface condensers and their auxiliaries are Westinghouse installations, the circulating water pumps being direct-connected to a motor at one end and through a reduction gear to a high-speed steam turbine at the other end.

The boiler room occupies the south end of the building, and the electrical galleries occupy the four stories and basement in the north end.

Features of Generator Room.

The ample, well lighted space between the two end sections constitutes the turbine room, in which two General Electric 12,500-kilowatt turbogenerators have been installed, sufficient room having been provided for a third generating unit at some future time. These two generators are designed for operating at a speed of 3600 revolutions, 6600 volts, 3 phase, 60 cycles. Each generator has direct-connected to it a General Electric 250-volt exciter set. In addition to this, there is being installed a Westinghouse 100-kilowatt steam-turbine-driven exciter set as auxiliary; the turbine and exciter unit are connected through reduction gears, the exciter being a 220-volt machine.

New Millers' Ford Station of the Dayton Power & Light Company.

By reason of the fact that Miami River is subject to high water and overflow, all boiler-room equipment and electrical apparatus in the basement divisions is placed above high-water mark.

Switchboard Equipment.

The four switchboards are arranged in a circle on the second floor, the backs of which are covered with steel doors and grill work. The boards are of Vermont blue marble, and consist of a control desk for controlling the present and future generator units; an exciter board, employed for controlling the electrically operated field switches and exciter switches located in a rheostat room on the first floor; a battery and meter board, for controlling the storage battery by which the oil switches are operated; here are also located temperature indicators which mark the temperatures of the different generator parts; the graphic recording meters are also on this board. The feeder board, on which are mounted indicating and recording meters for each outgoing feeder, contains the oil-switch control panel. There is an oil switch for each generator, the generator leads from each oil switch going to a selector-switch structure, and thence through two oil switches to either section of the ring bus which is divided into four sections, all of which are on the second floor.

The bus structure is of concrete and Alberene stone, covered by wire glass and asbestos fire doors. There are 16 group feeder switches on the second floor, by which a feeder may be switched on any bus section. The outgoing feeder switches and tie lines on the third floor are provided with reactances. The Westinghouse company, in addition to the above-described switchboards and accessories, has installed on the first floor of the electrical galleries two banks of transformers of 900-kilovolt-amperes each; and two 75-kilovolt-ampere lighting transformers, also several automatic induction regulators. There is to be installed on the first floor an additional switchboard for controlling pump motors and other auxiliary power equipment.

All energy is alternating current, 60 cycle, 3 phase, generated and distributed at 6600 volts. The voltage at the station is regulated by a Westinghouse regulator from an exciter switchboard on the third floor. The entire switchboard equipment was figured for eventually serving a station of six generators and two auxiliary exciters.

Feeder System.

The initial installation includes 13 outgoing feeders. All group feeders and feeder switches are provided with disconnecting switches on both sides of oil switches. The connections between the ring bus and group-feeder switches are 1,000,000 circular mil, 10/32 varnished cambric cable, with cable supports every four feet; and connections between the generator selector oil switches and the buses and bus-tie oil switches consist of 1,000,000 circular mil cable.

A more complete account of this very interesting plant will be presented in a later issue.

Classification of Demand Meters With Reference to Central-Station Rates

Resume of Demand-Meter Development and Factors to Consider in Their Application—Data Presented Before Ohio Meter Conference

By CHESTER I. HALL

IN 1892 Dr. John Hopkinson, of Manchester, England, propounded what was at that time a startling theory "that the charge for the electrical service rendered should bear some relation to the cost of rendering it." This general thought led to the analysis of central-station costs, and to the development of a great number of different kinds of rate systems. Dr. Hopkinson immediately applied his theory in a rate system, having as its primary object a uniform use of current for as many hours per day as possible, on account of the obviously profitable nature of this class of business.

The application of this system called for an initial payment by the customer of an amount dependent upon the maximum consumption which the customer would guarantee, and an additional charge dependent upon the number of kilowatt-hours used during the period. This system was found to have marked limitations, and in 1902 Arthur Wright, of Brighton, England, amplified and refined Dr. Hopkinson's ideas and developed what is known as the maximum-demand system, having a primary and secondary charge. The primary charge, which is generally larger, is based upon the maximum demand which the customer draws from the central station, and the secondary charge upon the kilowatt-hour consumption. Mr. Wright went farther and developed instruments for measuring the charge, resulting in what we have been using in America as the Wright demand meter.

At about this time many of the disciples of Dr. Hopkinson were giving very intensive thought to the application of such tariff systems, one of the principal ones being Charles H. Merz, who believed thoroughly in the primary and secondary charge, but disagreed with Wright in the method of measuring the maximum demand for obtaining the primary charge. Mr. Merz contended that the measurement of maximum demand by instruments operating upon the logarithmic law was markedly unfair in certain instances, but that a definite mathematical average of the load conditions would be equitable to all classes of customers. This conception led to the development of demand meters operating upon the principle of the integration of energy consumption over a definite time interval.

Since that time most of the development has been concerned with the application to existing conditions of the Hopkinson and Wright ideas, and to the development of accurate and reliable demand meters which will make such systems practicable. At the present time there are four general methods of obtaining a measure of the primary charges which are in more or less active use:

(1) The observation of instantaneous indicating instruments.

(2) Observational averages obtained by stopwatch readings of watt-hour meters, or the integration of instantaneous graphic recording instruments.

(3) Demand meters operating upon the lagged or logarithmic principle.

(4) Demand meters giving the result of integration over a definite time interval.

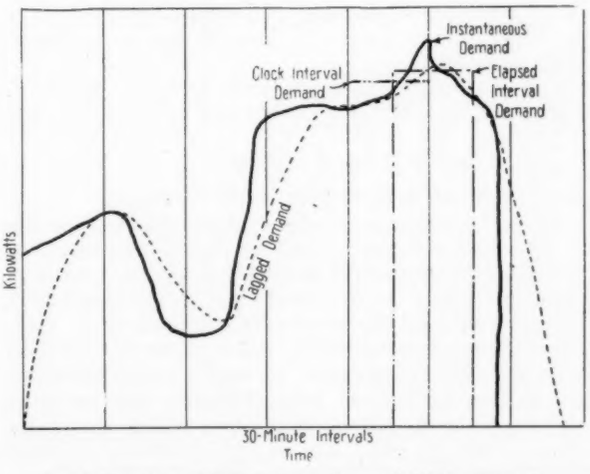
It is quite obvious that some of the above systems give erroneous readings under many normal operating conditions, and upon loads other than those of constant value.

Definitions of Factors.

In order to standardize and give a reference point from which measurements of maximum demand may be compared, central-station organizations of this country have settled upon the following definitions for demand, load-factor and diversity-factor:

The demand of an installation or system is the load which is drawn from the source of supply at the receiving terminals, averaged over a suitable and specified interval of time. Demand is expressed in kilowatts, kilovolt-amperes, amperes, or other suitable units.

The load-factor of a machine, plant or system is



Load Curve as Plotted from Demand-Meter Record.

the ratio of the average power to the maximum power during a certain period of time.

Diversity-factor is the ratio of the sum of the maximum power demands of the subdivisions of any system, or parts of a system, to the maximum demand of the whole system, or of the part of the system under consideration, measured at the point of supply.

Classification of Demand Meters.

There are two methods by which the classification of demand meters can be made: first, with respect to the kind of customer or size of installation; second, with respect to the amount or variety of information

desired. It is, of course, impossible to make hard and fast rules which will apply in every case, as the installation of devices of this nature is regulated very largely by local conditions, both operating and those imposed by contracts. It is, however, possible to make more or less accurate subdivisions under a classification, and the tabulation below will serve to indicate a generally accepted basis in use at the present time:

(a) Loads up to 0.1 kilowatt.
(b) 0.1 kilowatt to 2.5 kilowatts.
(c) 2.5 kilowatts to 50 kilowatts.
(d) 50 kilowatts to 100 kilowatts.
(e) From 100 kilowatts up.

Classification with Respect to Information Required.

(a) Applications requiring accurate limitations of demand.

(b) Applications which require indication of watt or kilowatt demand, without indicating time of day at which demand occurs.

(c) Applications requiring a permanent record of all of the demands of the month, together with the time of day at which each demand occurs.

(d) Applications which require the information as listed in class "c," but which require, on account of the large size of the installation, great accuracy of reading and permanency of record.

The two subdivisions "c" and "d" cover the problems connected with off-peak rate systems; contracts calling for the average of the three highest demands of the month, and similar special conditions.

There are available at the present time demand meters which fulfill the conditions set out in the previous tabulation. They may be roughly classified as follows:

(1) Demand limiters.

(2) Indicating demand meters giving integration over definite time interval. Lagged and logarithmic values of demand.

(3) Curve-drawing demand meters, including those giving instantaneous values and values integrated over definite time interval.

(4) Printing demand meters.

Importance of the Time Interval.

In the application of demand meters one of the most troublesome and much discussed points has been the time interval over which the integrations are to be made. It would be obviously unfair to penalize a customer for an instantaneous overload, such as is caused by short-circuited conditions or other accidental reasons. If the time interval is made excessive, then during the interval large demands may be made upon the central-station equipment, which would influence either the regulation of the line, or the capacity of the equipment necessary to serve such demands. The problem has been to arrive at some happy medium which would be equitable to both the central-station and the customer. A general statement of the ideal condition is found in the following:

The time interval should be so proportioned that only those demands which have an effect upon central-station operation or equipment are recognized and should be measured in proportion to their effect upon such operation or equipment.

This problem was first fully discussed by Louis A. Ferguson, of the Commonwealth Edison Company, of Chicago, in "Effect of Width of Maximum Demand on Rate-Making." Since that time many very careful investigations have been made upon actual service installations of many kinds, in order to determine the effect of various time intervals upon the value of demand obtained.

Effect of Time Intervals on Value of Demand.

A compilation and analysis of the results of tests made by different central-station companies under varying conditions will be illuminating in connection with the application of demand meters. While average variations will not necessarily indicate the actual differences to be found upon any specific customer by variations of the time interval, yet it is probable that the values given will roughly indicate the effect of such variations upon the revenue of the central station, which will be affected by all classes of customers.

Kilowatt Demand in Percentage of 30-Minute Demand.				Connected Load in Percentage of 30-Minute Demand.
Demand Interval				
5	15	30	60	
108.4	104.4	100	97.3	209

It is of interest to analyze the data further with relation to the general classification of customers, in order to determine roughly those classes for which the variation is greater than the average, and those for which the variation is less than the average.

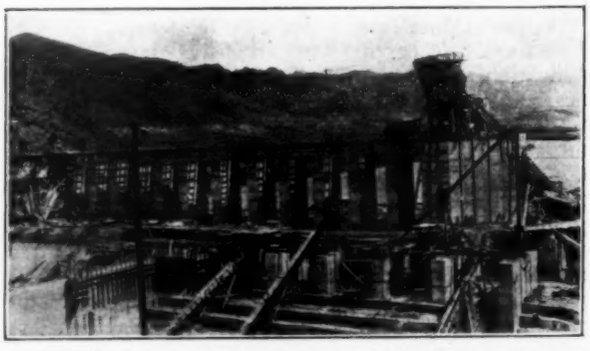
	Kilowatt Demand in Percentage of 30-Minute Demand.				Connected Load in Percentage of 30-Minute Demand.
	Demand Interval				
Class of Customer.	5	15	30	60	
Light manufacture	108	103.8	100	98	193
Heavy manufacture	106.2	104	100	97	178
Automobile manufacture.	108	103	100	99.2	211
Foundry	110.7	108	100	97	292
Wood working	107	102.3	100	94.5	199
Grain elevator	110.5	105.5	100	98	194

7890$ 7890$.. 7890$.. 7890$.. 7890$.. 7890$.. 7890$.. 7890'

PROGRESS ON HOLTER DAM CONSTRUCTION.

Montana Power Company's 40,000-Kilowatt Project Nearing Completion.

The accompanying illustration shows the progress which has been made in the construction of the new Holter dam of the Montana Power Company on the Missouri River. This project, which is designed to



Construction View of Holter Dam of Montana Power Company on Missouri River.

ultimately develop 40,000 kilowatts, was undertaken originally to supply energy for the additional electrification of the Chicago, Milwaukee & St. Paul Railroad. Because of the postponement of this work, however, efforts are being made to interest manufacturers of carbide, carborundum and other similar materials where cheap electrical energy is a necessity.

The dam is one of a chain which the Montana Power Company has built along the Missouri River and cost in the neighborhood of $4,000,000. The lake erected by the holding back of the water has a maximum head of 109 feet. The dam is 1350 feet long.

Railroad Electrification a Solution of Acute Transportation Problem

Important Address at Opening of Midwinter Convention of A. I. E. E.—Big Fuel Saving and Increase of Track Capacity Most Timely Advantages of Electrical Operation

By E. W. RICE, JR.

President, American Institute of Electrical Engineers.

MEMBERS of the electrical profession and industry have reason to be pleased with the contributions which they have made for the benefit of the world. While we are glad to think that our science and our industry are fundamentally devoted to the products and conditions of peace, we realize that in the electric light, searchlight, the X-ray, telephone, telegraph, wireless apparatus, electric motor, etc., electricity plays an important part in the grim business of war.

We are in the midst of an extraordinary coal famine, due to causes which it is perhaps undesirable for us to attempt to outline. However, I would like to point out how much worse the situation might have been were it not for the contributions of the electrical engineers, and also how much better our condition might have been if our contributions had been more extensively utilized.

National Importance of Electrification.

It permits speeding up train schedules 25 per cent and even more during very cold weather.

It would save two-thirds of the 150,000,000 tons of coal annually used by railroads.

By eliminating haulage of railroad coal, it would increase track capacity 10 per cent.

Where hydroelectric power is used, each horsepower-hour saves 6 pounds of coal.

Electrification is thoroughly practical and its advantages are demonstrated every day.

It offers the only speedy and economical solution of a grave national problem.

Its execution should therefore be undertaken without delay and a start made where traffic is most congested.

Electricity Has Increased Output of Coal Mines.

Suppose we assume that the present serious situation is due to a lack of production of coal. It is comforting to consider to what extent conditions surroundings such production have been improved and how the output of our coal mines has been already increased by the use of electrical devices in connection with coal mining—such, for example, as the electric light, electric coal cutter, electric drill and electric mining and hauling locomotive.

I have no figures before me, but I think it is a fair assumption that the output of coal mines should have been increased at least 25 per cent on the average by the employment of such electrical devices. If this estimate were cut down to 10 per cent it would still leave a possible increase in the tonnage of coal produced of something like 50,000,000 tons during the past year.

Big Increase in Railroad Capacity Through Electrification.

If, on the other hand, our situation is not due to a shortage in the production of coal, but rather to the failure of the distributive agencies of the country, which is more probable, it is certainly interesting to see just how this difficulty would have been largely removed if the railroads of the United States were operated by electricity instead of by steam.

Where electricity has been substituted for steam in the operation of railroads, fully 50 per cent increase in available capacity of existing tracks and other facilities has been demonstrated. This increased capacity has been due to a variety of causes, but largely to the increased reliability and capacity. At a time when the service, of electric locomotives, thus permitting a speeding up of train schedules by some 25 per cent under average conditions. Of course, under the paralyzing conditions which prevail in extremely cold weather, when the steam locomotives practically go out of business, the electric locomotives make an even better showing. It is well known that extreme cold (aside from the physical condition of the traffic rail) does not hinder the operation of the electric locomotive but actually increases its hauling capacity, under all conditions of steam locomotive is using up all its energy by radiation from its boiler and engine into the atmosphere, with the result that practically no useful power is avaliable to move the train, the electric locomotive is operating under its most efficient conditions and may even work at a greater load than in warm weather. It may, therefore, be said that cold weather offers no terrors to an electrified road but, on the contrary, it is a stimulant to better performance instead of a cause of prostration and paralysis.

Enormous Fuel Saving From Electric Operation.

But this is not all. It is estimated that something like 150,000,000 tons of coal were consumed by the railroads in the year 1917. Now we know from the results obtained from such electrical operation of railroads as we already have in this country that it would be possible to save at least two-thirds of this coal, if steam locomotives. On this basis there would be a electric locomotives were substituted for the present saving of over 100,000,000 tons of coal in one year. This is an amount three times as large as the total coal exported from the United States during 1917.

The carrying capacity of our steam roads is also seriously restricted by the movement of coal required for haulage of the trains themselves. It is estimated that fully 10 per cent of the total ton-mileage movement behind the engine drawbar is made up of com-

pany coal and coal cars, including in this connection the steam-engine tender and its contents. In other words, the useful or revenue-carrying capacity of our steam roads could be increased about 10 per cent with existing track facilities by eliminating the entire company coal movement.

I have not mentioned the consumption of oil by the railroads, which we are told amounted in 1915 to something like 40,000,000 barrels, nearly 15 per cent of the total oil produced. This fuel is entirely too valuable to be used in a wasteful manner. It is important for many reasons that such a wonderful fuel as oil should be most economically used, if for no other reason than that it will be needed for the ships of our forthcoming merchant marine, for the tractors that till our fields, and the motor trucks that serve as feeders to our railways.

Important Fuel Saving by Using Hydroelectric Power.

The possible use of water power should also be considered in this connection. It is estimated that there is not less than 25,000,000 horsepower of water power available in the United States, and if this were developed and could be used in driving our railroads, each horsepower so used would save at least six pounds of coal per horsepower-hour now burned under the boilers of our steam locomotives. It is true that this water power is not uniformly distributed in the districts where the railroad requirements are greatest, but the possibilities indicated by the figures are so impressive as to justify careful examination as to the extent to which water power could be so employed and the amount of coal which could be saved by its use. There is no doubt that a very considerable portion of the coal now wastefully used by the railroads could be released to the great and lasting advantage of the country.

The terrors of these "heatless" days will not have been without benefit if they direct the attention of the people and of our law makers to the frightful waste of two of our country's most valuable assets—our potential water power and our wonderful coal reserves. The first, potential water power, is being largely lost because most of it is allowed to run to waste, undeveloped, unused. The second asset, coal, is wasted for exactly the opposite reason. It is being used but in an extravagant and inefficient manner.

Our waterfalls constitute potential wealth which can only be truly conserved by development and use—millions of horsepower are running to waste every day, which once harnessed for the benefit of mankind, become a perpetual source of wealth and prosperity.

While the amount of coal in our country is enormous, it is definitely limited. While Providence has blessed us with a princely amount of potential riches in our coal beds, it is known that there is a finite limit to the amount of coal so stored and when this coal is once exhausted, it is gone forever. It is really terrifying to realize that 25 per cent of the total amount of coal which we are digging from the earth each year is burned to operate our railroads under such inefficient conditions that an average of at least six pounds of coal is required per horsepower-hour of work performed.

Economy of Power Supply From Steam-Turbine Stations.

The same amount of coal burned in a modern central power station would produce an equivalent of three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the source of power to the locomotive. Where water power may be utilized, as in our mountainous districts in the West, all of the coal used for steam locomotives can be saved. In the middle and eastern states, however, water powers are not sufficient and it will be necessary in a universal scheme of electrification that the locomotives be operated from steam-turbine stations, but as I have already stated, the operation of the electrified railroads from steam-turbine stations will result in the saving of two-thirds of the coal now employed for equivalent tonnage movement by steam locomotives.

It is, therefore, not too much to say that, if the roads of the country were now electrified, no breakdown of our coal supply, due to failure of distribution, would exist. What this would mean for the comfort of the people and the vigorous prosecution of the war, I will leave for you to imagine.

Electrification Only Way by Which Railroad Problem Can Be Quickly and Cheaply Solved.

Of course, this picture which I have briefly and inadequately sketched of the great benefits which our country would have received if the roads had been electrified does not improve our present situation and it may be claimed that any discussion of such a subject at this time is of an academic nature. This point of view is in a sense true, but I think that we can properly take time to consider it because of the effect which it may have upon our future efforts. This picture is not merely an inventor's dream, but is based upon the solid foundation of actual achievement. We have had enough experience upon which to base a fairly accurate determination of the stupendous advantages and savings which will surely follow the general electrification of the railroads; in fact, I think we can demonstrate that there is no other way known to us by which the railroad problem facing the country can be as quickly and as cheaply solved as by electrification.

The solution of the railroad problem would also "kill two birds with one stone" by solving the fuel problem at the same time.

If it is a fact, as has been stated, that the steam railroads of the country have failed to keep pace with the country's productive capacity—the increased output of manufacturing industries, the extension of agriculture and other demands for transportation—it is obvious that if the country is to go ahead, the railroad transportation problem must be solved and it must be solved at the earliest possible date. It becomes a matter of national importance that the best solution should be reached in the shortest possible time. That solution is best which will give the greatest amount of transportation over existing tracks, in the most reliable manner and, if possible, at the lowest operating cost.

Significance of Electrification to the Profession and Industry.

We electrical engineers are confident that we can make good our claim that the best solution is to be found in a general electrification of the railroads. That such a solution would be of great advantage to our profession and to our industry is important, although not as important as the great advantage which it would be to our country, freeing it as it would from the present threatened paralysis of business, possibility of untold human suffering and incalculable financial loss.

It should give us courage and optimism for the

future of our profession to contemplate the service which we may render in this direction, and which, it seems to me, is immediately at hand.

It should arouse in all of us, and particularly in the younger engineers, an enthusiastic confidence in the present and future stability and value of our profession and of the electrical industry. It should satisfy the young engineer that the opportunity for him to render important service is as real and great today as it has been in the past for those of us who have seen and participated in the marvelous growth of the industry up to the present time.

Nothing About Electrification That Is Experimental or Uncertain.

We would not be justified in being so confident of the benefits of electrification of railroads if every element in the problem had not been solved in a thoroughly practical manner. The electric generating power stations, operated either by water or by steam turbines, have reached the highest degree of perfection, efficiency and reliability, while the transmission of electricity over long distances, with reliability, has become a commonplace. Electric locomotives capable of hauling the heaviest trains at the highest speeds, up and down the heaviest grades, have been built and found in practical operation to meet every requirement of an exacting service.

There is, therefore, no element of uncertainty, nothing experimental or problematical, which should cause us to hesitate in pressing our claims upon the attention of the country.

Electrification of railroads has progressed with relative slowness during these many years, waiting upon the development and perfection of all of the processes of generation and trasmission and of the perfection of the electric locomotive itself. When all these elements had been perfected, as they now have been for several years, the railroads found themselves without the necessary capital to make the investment.

Electrification Big Task—So Is Any Effort to Increase Transportation Facilities.

I realize that the task of electrifying all of the steam railroads of the country is one of tremendous proportions. It would require under the best of conditions many years to complete and demand the expenditure of billions of dollars.

The country, however, has clearly outgrown its railway facilities and it would require, in any event, the expenditure of billions of dollars and many years of time to bring the transportation facilities up to the country's requirements.

Starting Electrification in Mountainous and Other Congested Sections.

It is not necessary that electrification should be universal in order to obtain much of its benefits. It is probable that one of the most serious limitations of our transportation system, at least in so far as the supply of coal is concerned, is to be found in the mountainous districts and it is precisely in such situations that electrification has demonstrated its greatest value. Electrification of a railroad in a mountainous district will in the worst cases enable double the amount of traffic to be moved over existing tracks and grades.

If a general scheme of electrification were decided upon, the natural procedure would be, therefore, to electrify those portions of the steam railroads which will show the greatest results and give the greatest relief from existing congestion. Electrification of such sections of the steam railroads would have an immediate and beneficial effect upon the entire transportation system of the country, and it is our belief that electrification offers the quickest, best and most efficient solution that is to be obtained.

Imperative Need for Making an Early Start.

It may be said that the present is not a propitious time in which to deflect any of the country's money into railroad electrification. I think that, in spite of the enormous advantages of which I have spoken, we would be inclined to agree with such a point of view if it were not for the recent unpleasant demonstration of the failure of our railroad transportation systems to meet the demands which have been placed upon them by the industries, aggravated it is true by the war conditions, and also by the unkindness of the weather.

After all, the question for the country to decide is whether we dare to limp along with the present conditions of restricted production, due to limited transportation, at a time when the world demands and expects from us the greatest possible increase in our efficiency and total production.

What assurance have we that the present conditions are temporary, and even if they improve, as they will with the coming of warm weather, what are we going to do next winter? Of course, even if we should start electrification at once, we could not have all our railroads electrified by next winter, but we could have a good start, and as Sherman said about the resumption of specie payments—"The way to resume is to resume," so "The way to electrify is to electrify."

WAR CHEST PLAN A SUCCESS.

Electrical Industry Contributes Heavily to War Relief Work at Rome, N. Y.

The war-relief work inaugurated last November by the Rome War Chest Association, at Rome, N. Y., stands out as a conspicuous example of the effectiveness of organized community effort under capable leaders. Funds for the War Chest were raised by annual dues of members, and nearly every one in that city became a member. The amounts of dues for individuals and companies were graded according to respective incomes. By this method, $346,000 per year was pledged for the period of the war. An attractive bronze button was adopted for members, and the community of 25,000 inhabitants showed up with 8700 contributing members.

It is interesting to note that the largest corporations' and employees' subscriptions came from companies closely identified with the electrical industry, such as the Rome Brass & Copper Company, Rome Wire Company, Rome Manufacturing Company, Rome Electrical Company, Spargo Wire Company, Rome Hollow Wire & Tube Company, and the Rome Turney Radiator Company. These are the same companies who caused the large electric sign to be placed near the New York Central depot, reading: "1/10 of the copper used in the United States is manufactured in Rome."

H. T. Dyett, president and treasurer of the Rome Wire Company, was one of the hardest workers in the campaign and its success was in no small measure due to his untiring efforts.

POWER TRUCK FOR GENERAL UTILITY LINE WORK.

The horse-drawn lineman's wagon and line gang's truck are fast being superseded by mechanically propelled vehicles with their greater speed, lower cost of operation, greater ability for work without need for rest, and many other reasons. The horse is still used for the long-distance transmission line in mountain trails, but in cities and where the going is good the electric battery or gasoline trucks are used almost exclusively.

The motor truck can be adapted readily to every phase of overhead and underground transmission and distribution work. The body may be varied from the kitchen-cabinet variety, which contains everything that

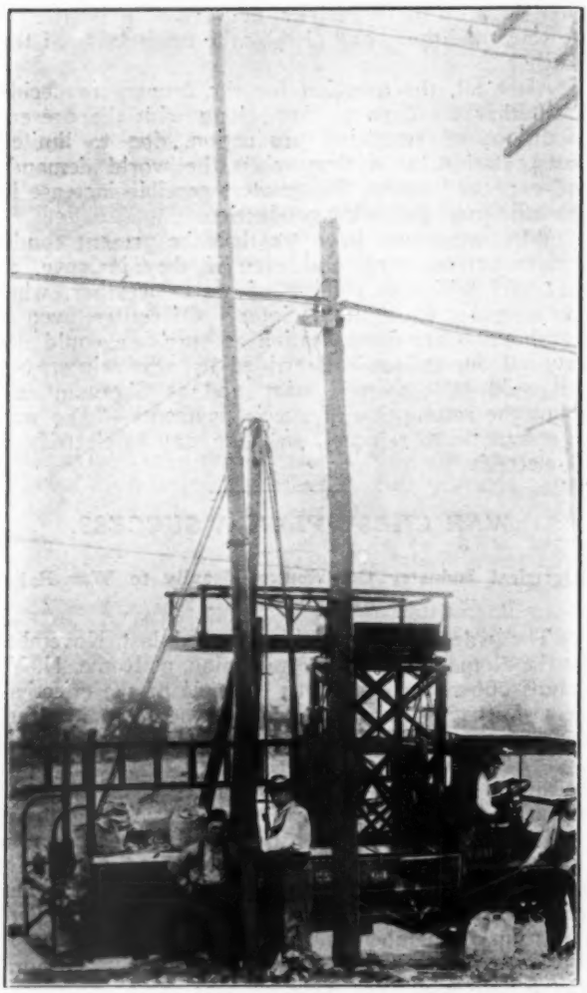


Fig. 1.—The Tower-Type Wagon Using Power Winch for Pole Setting and Removing.

goes to the building of a pole line, from pole paint to pole step, lunch to life-saving apparatus. A typical truck can be as economically and conveniently used for stringing street-railway trolley, setting the trolley poles and answering calls of "trolley down" as for hauling underground cables to the manhole and then pulling them through the underground ducts. Tree trimming, a more important operation since the tungsten has replaced the arc lamp on such a large scale, can be quickly and properly done with the truck of the tower type. Setting a pole, hauling up a trans-

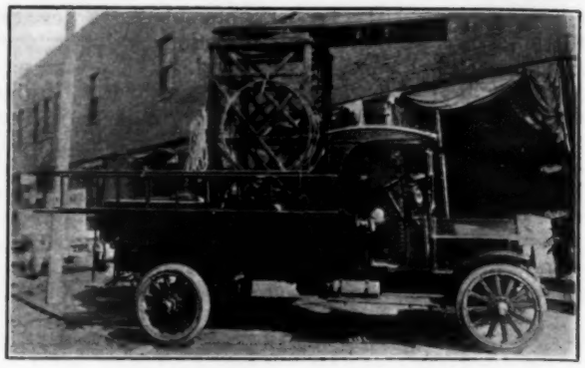


Fig. 2.—Garford Truck Containing All Necessities for Emergency Linework.

former and hanging it are also done more simply, more quickly and more cheaply—matters of importance when there is so much to do with few men to do it.

The truck with a tower makes a very useful general utility line truck. Tools and transformers may be placed on the tower platform which is then raised, reducing much of the ground work, accidents and loss of time. The power winch shown at the side of the truck in Fig. 1 is useful for many purposes, one of which is shown, namely, setting a pole, to be followed later by pulling out the discarded wooden pole and carting it away, as shown in Fig. 3. Much more work, and a better job, can be done with fewer men with the truck. When stringing three-phase circuits the three cables may be taken up by an equalizing bar which in turn is fastened to the tower by a dynamometer. The truck is then started up and pulls all conductors staunch at equal stress.

Light is an important factor in safety and good workmanship. Apart from the headlights and rear light, facilities may, where desired, enable portable cord to be plugged into the side of the truck, the lamp in turn being used in manholes and similar places. Again, a lamp and reflector may be hung on the tower and used as a searchlight along the pole line, or for flood lighting during night and emergency work in finding and repairing trouble.

The uses for such a truck are endless, for it covers every phase of underground and overhead work, as well as tree trimming, maintenance of arc and tungsten lamps and the cleaning of globes, trolley stringing, and so forth. The truck shown is made by the Garford Motor Truck Company, Lima, Ohio. It is fast, and sufficiently heavy to give the required ruggedness for a severe class of work. The body has been designed for the various classes of work, and every bit of space has been utilized, under seats, under the tower and elsewhere, for storage of materials or tools.

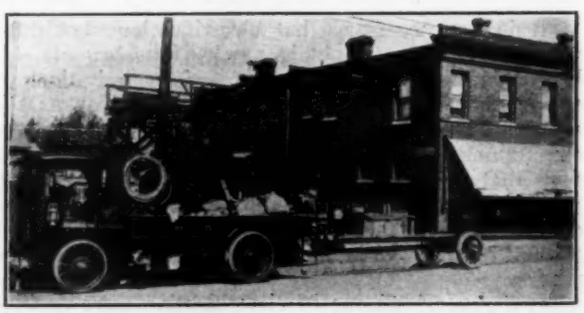


Fig. 3.—Garford Truck Starting Out for Day's Work With Complete Equipment, and Poles on Trailer.

Editorial Comment

Railroad Electrification as a National Issue

WHEN the recent drastic industrial shutdown was decreed as an urgent fuel-conservation measure it was tacitly admitted that one of the primary reasons for the embargo on business was the inability of the railroads to handle the enormous traffic that had congested their lines. This also was the prime reason that had compelled the Government to take over the roads a few weeks earlier. These facts forcibly brought home to the nation that it was confronted with a very grave transportation problem. Although we have more railroad development than any other country, here was a national crisis in which this vital link in our hurried preparations for war proved unequal to its tasks.

Analysis of the railroad congestion showed that it was most acute at the terminals and in certain mountain divisions where the train movements were slowed down by lack of track capacity or heavy grades. Electrical men conversant with the operation of electrified railroad divisions quickly saw that electricity would bring the remedy for the severe congestion at these critical points, since it had in numerous cases clearly demonstrated its greatest advantages at just such places where congestion and operating conditions were very severe. Few were willing to come out in strong advocacy of such electrification at the present time, however, on account of the known great difficulties in financing any betterments involving heavy capital outlay.

It has remained for E. W. Rice, Jr., president of the American Institute of Electrical Engineers, to point out the peculiar timeliness of such railroad electrification. In a masterly and far-sighted address presented before last week's midwinter convention of that body, he has made a most able presentation of electrification as an immediate national problem. On account of the great importance of this matter to the electrical industry we reproduce Mr. Rice's address in full on other pages of this issue. A man of large affairs, at the head of one of the most extensive manufacturing organizations in the country, Mr. Rice has naturally viewed the entire problem from a broad standpoint and in its proper relation to fuel conservation, increase of track capacity and schedule speed, elimination of wasteful haulage of steam-locomotive coal, water-power development, power supply from efficient steam-turbine generating stations, reliability, finance and peculiar timeliness.

Mr. Rice points out that an extraordinary saving of at least 100,000,000 tons, or two-thirds of all the coal now used annually by the railroads, would result from general electrification of lines throughout the country. This is twice the total coal shortage reported for 1917. He shows that the electric locomotive and its power supply has for many years been clearly beyond the experimental stage. Its efficiency is greatly superior to that of its steam rival, especially during very cold weather. This was very forcibly demonstrated during the severe blizzards last month when, instead of developing exceptional power to force their way through heavy snowdrifts, the steam locomotives fell down woefully due to their heat losses increasing enormously with the severity of the weather. The protracted delays to steam trains were caused principally by this greatly lowered efficiency.

Without attempting to review Mr. Rice's clear statement of the strong case for electrification, it may be well to emphasize some of his conclusions, especially relative to financing the improvement. The urgency of immediate increase of capacity at congested points so as to facilitate the movement of traffic at these places is of course manifest. These betterments will in any case involve very large capital outlays. The most expedient remedy lies in increasing the capacity of the present trackage. This can be done by electrification, which in fact is the only speedy and also the cheapest solution of the problem. Universal railroad electrification, while highly desirable is now out of the question. Successful prosecution of the war, however, requires that every effort be made to prevent another industrial tieup which is likely to cause serious consequences. The restricted sections of our transportation system must therefore be attacked without delay. They offer an exceptionally favorable opportunity to begin actively on the general electrification of our railroads, which holds out so much promise of important savings and other attendant advantages to the country.

We heartily commend Mr. Rice's able address to the Director-General of Railways, to the executives of the railroad companies, and the railroad industry as a whole. We hope that it will help materially in bringing railroad men to a realization of the numerous advantages that electrification has to offer and induce them to bring it about to the greatest extent possible under prevailing conditions and make it universal as soon after the war as practicable.

Repeal the Postal Bill

THE rejection by Congress of the provision in the Post Office Appropriation Bill, increasing the postage rate upon periodicals is a national necessity. The operation of such a bill would impede national development, retard progress and lower the

efficiency of the individual and nation as a whole. The taxation of our journals by imposing an increased rate of postage is not a matter affecting the publisher and subscriber alone, but one with which the nation as a whole is concerned, and very closely. Many of the journals are a national asset of a high order for they are doing a magnificent work in the service of the country. The imposition of increased postage would restrict circulation, place an additional burden upon the publisher and one which would have to be borne eventually if not immediately by the reading public. As it is, the present high price of paper is working a hardship with many of the nation's periodicals; in some instances subscriptions have already been increased, in others circulation curtailed and reading matter retrenched to the detriment of the publisher, the subscriber and the advertiser.

The work of many of this country's journals is not merely individual but national. Perhaps no two things have done more to bring North and South, East and West close together than have the railroads and the nation's journals. By means of low postage rates it has been possible to dispatch these journals broadcast over the country, placing them within the financial reach of every one. Many of these technical journals, whether in the field of engineering, medicine, law, art or any other domestic, industrial or scientific sphere of endeavor, are fulfilling a function impossible to evaluate. They are circulating knowledge and experience, creating inspiration, building incentive from the example set by others, and making possible the intimate exchange of ideas. To the credit of the technical journals in no small measure is due the rapid development of civilization and human progress of the last decade. The technical journal brings one into intimate contact with the world's work, and dreams and aspirations and accomplishments of others; through it one learns what the world is doing, how it is doing it and why. The technical journal imparts information, it suggests, inspires, creates and guides. Surely this is the most efficient manner of using knowledge, and permits of its utilization to the best advantage. The technical periodical is not a luxury. It is a necessity. It is necessary to the engineer or any one else endeavoring to keep abreast in his profession or calling and obtain eminence in his domain. To remain uninformed today is not merely to stagnate, but is to fall behind.

Postage rates have frequently been reduced between this country and foreign lands that this country might bring itself nearer other countries in thought and act. Surely it is a shortsighted policy to differentiate between the citizens in one part of the country and another by restricting the distribution of knowledge, retarding the circulation of news of the progress of the world of commerce and of men, by imposing a cost for mailing that will remove this news from a large portion of the country's citizens. Is this not an act to foster sectionalism, which the journals and cheap postage have done so much to overcome?

The Postal Bill is anathema to conservation and the mobilization of the national industries. It would stunt instead of hastening and encouraging individual and national growth. The Postal Bill is a mistaken, shortsighted, retrogressive piece of legislation, which if allowed to stand, would prove costly to the individual, the community and the nation. It would almost disastrously hamper what is probably the chief medium for the prompt dissemination of knowledge that is so essential to continued national progress. The bill should be promptly repealed.

Making Residence Electric Service More Complete

FROM time to time there has been considerable pressure brought to bear on architects and electrical contractors with a view to impressing on them the need for a sufficient number of conveniently located outlets in the home. Many otherwise completely equipped dwellings have been sadly neglected in this respect and undoubtedly the use of electrical appliances has been retarded because of the difficulty in making proper socket connections.

Architects are principally to blame for this condition, and anything that can be done to convince them of the importance of giving due consideration in their specifications to the present need for wall and floor receptacles will be well worth while. Electrical contractors realize the conditions. Their failing has been an eagerness to reduce wiring cost so that they would be insured of receiving the contract.

The present time is an admirable one to remedy, to some extent at least, these evils in houses already wired. In the first place there is at present very little activity in new house wiring and most contractors have the time and facilities for conducting a campaign of this kind. Secondly, the use of electrical appliances is rapidly extending because it is being realized that they are labor savers, they conserve fuel, food, transportation, etc., and their cost of operation is low.

It is obvious, therefore, that a campaign to install wall or floor receptacles would have a timely appeal. Elsewhere in this issue we describe a campaign of this sort being conducted by the Public Service Company of Northern Illinois. Central stations and contractors can well afford to give some attention to this subject as it enables the former to acquire new business without capital expenditures and the latter to derive business from the otherwise inactive residence field.

Strikes

IT is all very well to bring strikes to an end; but what is of far more importance now is that no strikes, likely to interfere with the Government's war operations, shall be permitted to begin. The nation cannot afford to lose time even on arbitration. No strikes are tolerated on the battle front; they should not be tolerated in the rear.

Week's Events

Jobbers Meet in Philadelphia—Midwinter Convention of American Institute—Millar on Lighting Curtailment

JOBBERS DISCUSS TRADE ACCEPTANCES AND BUSINESS CONDITIONS.

Meeting at Philadelphia Characterized by Addresses by Prominent Speakers—New Officers Elected.

About 40 members of the Atlantic Division of the Electrical Supply Jobbers' Association were present at the February 13 meeting, held in Philadelphia at the Bellevue-Stratford. The program contained four features, all of which were of exceptional interest. Chairman W. E. Robertson conducted the meeting.

THE TRADE ACCEPTANCE.

The first to speak was M. A. Curran, general credit manager of the Western Electric Company, his subject being "A Plan for the Practical Application of Trade Acceptances."

Since the new law went into effect, recognizing trade acceptances, there have been some who have seized upon it as a cure-all and have tried to put it into effect heedlessly and in a manner to do more harm than good.

That eventually it will be of great benefit to all industries is unquestioned, but in the speaker's opinion the trade acceptance should be adopted gradually.

In the first place, banks must co-operate by discounting the drafts. Therefore, do not seek to force through a lot of "chicken-feed" items. Mr. Curran suggested that trade acceptance drafts should not be written for less amounts than $100. Moreover, do not try to bring all the trade at one sweep down to the 30-day trade acceptance basis; rather go about it by bringing the 90-day customer down to the 60-day basis, the 60-day customer to the 30-day basis, etc.

Some suggestions were also made as to the correct form of draft.

So important was this matter of trade acceptances considered, that the meeting instructed the division secretary, E. Donald Tolles, to take the time to visit each member company and urge upon the auditing and treasury departments the adoption of the plan and explain the details as they are set forth.

OPPORTUNITY FOR SALE OF APPLIANCES.

J. M. Wakeman, general manager of the Society for Electrical Development, was the next on the program, with a talk on "Opportunities for Profitably Increasing the Business of Electrical Jobbers." This took the form of remarks aimed at increasing the sale of electrical appliances at this critical time; for the reason that the use of such appliances, particularly those used in cooking, result in the saving of fuel and food. Most central stations, even though they are turning away power business because of lack of ability to finance extensions capable of taking it on, are still able to saturate their lines with more of this cooking business.

He quoted some statistics in regard to the amount of fuel burned in coal ranges and the proportion of this which could be saved if electricity were to displace the coal ranges.

Therefore, it is patriotic co-operation to encourage the use of electrical household appliances. No one need hold back because of a feeling that they come under the head of non-essentials or luxuries. And anyone who shrinks and abandons his markets at this time is doing himself and his industry an injustice.

THE WAR AND BUSINESS.

The Babson Statistical organization on co-operation always has something of interest to every line of business, and experts of exceptional personality to present the facts. Such a man was G. E. MacIlwain, who addressed the meeting upon the subject: "What the War Means to American Business."

It was a stirring talk and one which brought a commensurate round of applause, and the speaker received a standing vote of thanks for his pains.

There was not sufficient time to go into the subject with all the thoroughness of a characteristic Babson analysis, but Mr. MacIlwain did give the hearers some straight-from-the-shoulder facts about the ruts that the European countries and America had been getting into, and how the war, awful as it is, still is acting as a great leveler in the industrial activities of the world. He spoke of the ways in which it is waking up England, France and the United States to a realization of their industrial responsibilities. We will face a different Europe when the war is over.

TAX RETURN STATEMENTS.

"How Electrical Jobbers Should Prepare Returns Under the Tax Law." This question was discussed by C. E. Patterson, comptroller, and J. F. Zoller, tax attorney of the General Electric Company. It is a job for both an auditor and a lawyer. They "got away with it" very creditably, considering that the Form 1031, Corporation Income Tax Return, had only been out about four days, and Form 1103, Excess Profits Tax, had not yet been issued by the Government.

It was urged, by the way, that every member obtain from the collector in his district both of these forms as soon as possible, also a copy of Regulations 41, covering War Excess Profits Tax.

Both the gentlemen were excellent speakers and made this perplexing problem as clear as it could be made with the information available at the time. But every individual company's problem is going to differ from that of every other, when it comes to applying this law, which brought up the advisability of the jobbers getting a uniform system of accounting into effect as soon as possible. If they all kept their books alike many of the difficulties would be eliminated.

ELECTION OF OFFICERS.

After the presentation of these papers an executive session was held for the election of officers. This resulted as follows:

Division Chairman, E. C. Graham, National Electrical Supply Company, Washington, D. C.

Executive Committeemen:

F. S. Price, Pettingill, Andrews Company, Boston, Mass.

H. M. Savage, Wetmore, Savage Electric Company, Boston, Mass.

A. M. Little, Mohawk Electrical Supply Company, Syracuse, N. Y.

W. E. Robertson, Robertson Cataract Electric Company, Buffalo, N. Y.

W. I. Bickford, Iron City Electric Company, Pittsburgh, Pa.

L. V. Garron, Philadelphia Electric Company, Philadelphia, Pa.

H. T. Hochhausen, Brooklyn Electrical Supply Company, Brooklyn, N. Y.

E. Donald Tolles was continued as secretary, with office at 52 Broadway, New York, N. Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS HOLDS MIDWINTER CONVENTION.

President's Address and Nine Technical Papers Presented at Two-Day Meeting in New York.

Although not largely attended on account of the war, the sixth annual midwinter convention of the American Institute of Electrical Engineers held in New York City on February 15 and 16 was the occasion of one of the most important addresses on railroad electrification as yet presented. This was the address of President E. W. Rice, Jr., in opening the meeting on Friday morning. It is reproduced in full on other pages of this issue. The address created a profound impression on all present by showing that electrification offers the only practical and economical solution of the aggravated transportation congestion and the coal shortage resulting therefrom.

Circuit-Breaker Ratings.

Coming to the technical part of the program, the first paper was by E. M. Hewlett, J. M. Mahoney and G. A. Burnham, on the subject "Rating and Selection of Oil Circuit-Breakers." This was briefly abstracted by Mr. Burnham, Mr. Hewlett and Mr. Mahoney adding some supplementary remarks. Probably there is no electrical equipment of equal importance where there is so little uniformity of method in determining upon the capacity and class of equipment to install to correct given requirements. The object of the paper was to suggest a way whereby a more uniform statement could be secured from manufacturers with reference to rating and recommended selection.

What are the factors involved in the selection? How should the A. I. E. E. rules on the subject be applied? Are there any average-system short-circuit characteristics that can be used in selecting oil circuit-breakers for certain systems? These were the three lines of study laid down in the paper. To determine the short-circuit transient for a system by actual test involves much expense and delay, which is also true of such determination by calculation.

The authors suggested a set of decrement curves based upon several assumptions: transient characteristics of alternators of normal design, determined from oscillograph tests; that the effect of capacitance and resistance be neglected; that contact resistance at short circuit is zero; that the alternator is carrying full load 80 per cent power-factor; that the short circuit was established at the point of the pressure wave corresponding to maximum possible instantaneous current, and that no automatic voltage regulators are used.

It was hardly to be expected that the paper would be a solution of the difficulties found in this field, indeed, as one of the authors expressed it, the paper was rather a bench mark to work out from in future discussions.

Meters and Measurements.

In the absence of President Rice, the meeting on Friday afternoon was called to order by B. A. Behrend, as the senior vice-president present. The general subject for this session was meters and measurements, the program comprising four papers.

Two of these papers were of the same order, namely: "A New Standard for Current and Potential," by C. T. Allcutt, and "The Thermoelectric Standard Cell," by C. A. Hoxie. The two were abstracted by their authors and then discussed together.

The Allcutt paper described a cell which has been devised as a substitute for the ordinary standard cell, and intended for use particularly with potentiometers employed in commercial service, especially in connection with measurements of temperature by means of thermocouples. This is a self-contained device embodying a fine filament in a vacuum bulb as well as a variable-resistance element. The work done in connection with the development of this new standard has demonstrated that it may be relied upon to maintain an accuracy of $\pm$ 0.1 per cent.

Mr. Hoxie's experiments were made with a view to obtaining a secondary standard of electromotive force by utilizing the electromotive force of a thermocouple. The operation of the cell consists in balancing the potential across a resistance against the thermoelectric electromotive force of the thermocouple. This requires a definite value of current through a filament which is a source of heat for the thermocouple. The temperature coefficient has different values, depending upon the temperature of the heating filament. Means are provided for compensating for the temperature coefficient of the cell. The construction of the cell was discussed in detail, particularly the use of gas in the bulb. A review of the characteristics brings out several advantages of the thermoelectric standard cell. The results of permanency tests on a number of cells are shown. The standard cell has been successfully applied to potentiometers designed for thermocouple work. Further experimental work on this cell is now under way.

In the discussion, Mr. Stockwell stated that the two devices presented as substitutes for the standard cell fall short of the latter in accuracy, simplicity and cheapness. Why resort to such substitutes when standard cadmium cells can easily be made up at a cost of approximately $3.00?

To this point Mr. Allcutt replied that his substitute embodied not only the cell element but also the resistance unit which must be employed in connection with the potentiometer. In this case the unit device corresponds with and replaces the standard cell and standard resistance.

"The Character of the Thermal-Storage-Demand Meter," by P. M. Lincoln, and "Measurement of Power Losses in Dielectrics of Three-Conductor High-Tension Cables," F. M. Farmer, were two highly technical contributions.

Mr. Lincoln gave a detailed description of the construction of a thermal-storage-demand meter and

showed wherein it always indicates what may be called "logarithmic average" rather than "arithmetic average" of power consumption, heretofore indicated by practically all demand meters. The inherent faults of the "arithmetic average" or "block interval" meter were described and examples given demonstrating that the thermal-storage meter alone recognizes the true heating effect that fixes size of equipment and therefore cost that should be assessed against the customer.

Mr. Farmer described a method used at the Electrical Testing Laboratories, New York City, for measuring the dielectric power losses in 10-foot samples of three-conductor cables with three-phase potential applied to the cable.

These papers were discussed by Mr. Hall, Mr. Pratt, Dr. Lloyd and A. S. Albright.

PRESIDENT RICE ON THE WAR SITUATION.

Most of the members adjourned to the Cafe Boulevard for dinner before attending the evening session. A feature of interest in connection with the dinner was a patriotic address by President Rice—it was optimistic but with a tone of caution, giving credit where credit was due, but emphasizing the need and value of just criticism.

Mr. Rice showed how fortunate our country was in having as its President a spokesman who presented the ideals of the American people in so clear and so impressive a manner as to be accepted as the leading spokesman on our side of the war. Speaking of the mixed impressions with which we receive the conflicting statements of our progress in taking up active war work, Mr. Rice cautioned his hearers to remember the extraordinary magnitude of the task. In view of our unpreparedness we could not expect greater progress than has been achieved. The mistakes made since we entered the war are negligible compared to the overwhelming mistake of failure to prepare during 1915 and 1916. He was inclined to believe that the criticism manifested in many quarters would be allayed by the selection of a war cabinet consisting of not one political party, but the most capable leaders and administrators in the country, men who would inspire confidence in all quarters.

There is needed primarily a leadership by men trained in the spirit of co-operation. No single element by itself—neither capital or labor alone, nor the Army or Navy alone—can win the war. There must be the most perfect "team play" by all.

Dr. A. C. Crehore addressed the evening meeting upon the subject of "Some Applications of Electromagnetic Theory to Matter." As might be expected from the title, this lecture was highly scientific. After explaining the electromagnetic theory, it was stated that results obtained agree with the form of the atomic theory and indicate:

a. The weight of an atom is proportional to the total kinetic energy of the electrons it contains, relative to the center of the atom.

b. The weight of any ring of electrons in an atom is fixed independent of its radius, and always contributes the same amount toward the total weight of an atom.

c. The weights of all atoms have been calculated, except the rare earths, on the above basis of rings of electrons. 52 out of 70 elements come within the chemist's error in measuring the weights. Most of the weights are obtained from three numbers only.

d. Most of the elements thus determined are based upon rings of four electrons as fundamental.

e. The halogens are based upon rings of five, and iron upon rings of six.

ALTERNATING-CURRENT COMMUTATOR MOTORS.

The concluding session on Saturday morning was occupied with the above general subject. Marius A. Latour offered a carefully prepared paper upon "Commutation in Alternating-Current Machinery," which was translated and presented at the meeting by C. O. Mailloux. W. C. K. Altes discussed "The Polyphase Shunt Motor." V. Karapetoff described his "Secomor"—a kinematic device which initiates the performance of a series-wound commutating motor.

This latter is a subject of great popular and commercial interest. Mr. Karapetoff showed how this comparatively simple mechanical device can be used to design motors with a few simple manipulations.

The device consists of four bars of adjustable useful length and with adjustable angles. These bars can be set in a combination to represent the vector diagram of voltages in a motor with any desired constants. By moving the bars to vary the load, complete performance characteristics of the motor can be obtained, including the speed, the torque, the power-factor, etc. An additional device, called the impedometer, permits one to take into account the impedance drop in the machine. An adjustable saturation curve made of soft wire is used in connection with the secomor, to enable one to investigate the effect of saturation.

DISADVANTAGES OF LIGHTING CURTAILMENT DISCLOSED.

Paper by P. S. Millar Points Out the Comparatively Small Saving in Coal Produced and Shows Other Shortcomings of the Present Policy.

The fallacy of lighting curtailment as a real coal-conservation measure was exposed in an important paper presented before a special meeting of the Illuminating Engineering Society held in New York City on February 14. The author was Preston S. Millar, past-president of the Society and general manager of the Electrical Testing Laboratories. His observations were made since the various light-curtailment orders were issued in the last few months and were aided by data and opinions furnished by some two dozen prominent lighting experts. Mr. Millar's paper was also presented before the Philadelphia Section of the Society on the evening of February 16.

In opening, Mr. Millar emphasized the need of eliminating all clearly manifest waste and extravagance in order to prosecute the war. Speaking of our dependence on artificial lighting, he said that a moment's contemplation of the curtailment of living which would ensue if there were no artificial light will convince of its invaluable and indispensable nature. The cost of artificial illumination of all kinds is about $500,000,000 annually, or ½ to 2 per cent of the total expenditure of the people. It compares with $665,000,000 spent for liquor, and $490,000,000 for tobacco.

The total coal output of the country in 1917 was about 640,000,000 tons, of which 36,000,000 tons were used in the production of electric light and power (exclusive of electric traction) and about 12,000,000 tons for the production of electric light. This latter figure shows that only about 2 per cent of the coal produced goes into electric light. The coal shortage is estimated at 50,000,000 tons. Therefore, if all electric lights were arbitrarily cut off the coal thereby saved would be only 24 per cent of the required total saving. A similar saving could be produced by re-

placing all private plant power with central-station service, or by maintaining the temperature of building interiors 3 or 4 degrees below the present value. If all electric light were wasted, the loss of coal would be but a small part of the total waste of which the country is guilty. As relatively little light is wasted, it is evident that the amount of coal that can be saved by curtailment of electric lighting is small. This is graphically shown in Fig. 1.

A consensus of 14 lighting experts shows that prior to the war too little artificial illumination was employed in industrial and commercial lighting to serve the best interests of the public. The most liberal use of artificial light in interiors attained a level only about one-quarter of the most feeble daylight employed in the same interiors. In general, therefore, artificial lighting standards have not been too high.

According to the consensus of 24 lighting experts reported in the paper, the amount of artificial light used should be increased in industrial and protective lighting in order to promote output, and should be reduced slightly in other classes of service in order to effect savings in coal. Experiments described show the output of a large machine shop to have been increased by 15 per cent in consequence of a trebling of the artificial lighting. This is an illustration of the reason why illumination should be increased in some classes of service. The adjustments thus indicated are given in the accompanying table.

ADJUSTMENT OF ILLUMINATION INTENSITIES WHICH OUGHT TO BE MADE FROM STANDARDS EXISTING BEFORE THE WAR, IN VIEW OF THE WAR AND FUEL SHORTAGE.

Class of Lighting Service	Per Cent Distribution	Desirable Adjustments in Intensity
Street	15	—5
Public Building	3	—10
Industrial	18	+50
Protective	1	+200
Commercial	20	—20
Residence	26	—20
Recreational	7	—40
Advertising	5	—80
Miscellaneous	5	—10
	100%	Net —7%

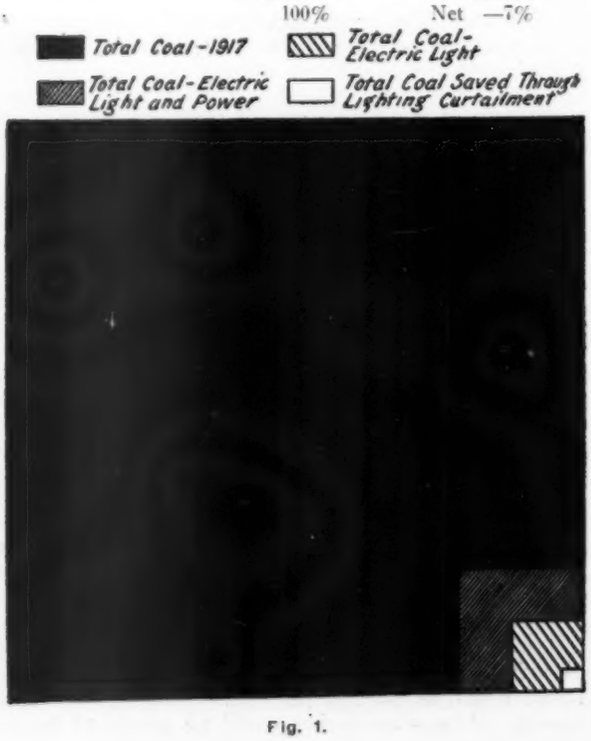

Total Coal-1917
Total Coal-Electric Light
Total Coal-Electric Light and Power
Total Coal Saved Through Lighting Curtailment

Fig. 1.

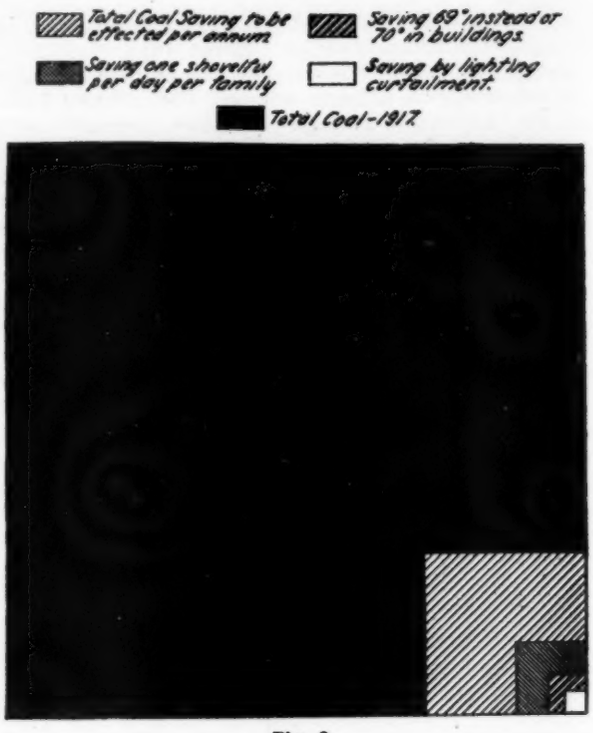

Total Coal Saving to be effected per annum
Saving 69° instead of 70° in buildings.
Saving one shovelful per day per family
Saving by lighting curtailment.
Total Coal-1917

Fig. 2.

A net saving of 7 per cent in artificial light is indicated by this consensus. Applied to coal, this means a net annual saving of 840,000 tons per annum. The amount of this saving in comparison with other coal savings is as follows and also shown in Fig. 2.

Total saving which must be accomplished	50,000,000 tons
Net saving thought desirable through curtailment of electric lighting	840,000 tons
Saving if one degree lower temperature is adopted for building interiors; i. e., 69° instead of 70° F.	3,000,000 tons
Saving if each family decreases by one shovelful its daily use of coal	15,000,000 tons

In curtailing artificial light to effect coal savings, the important thing is to eliminate waste of light. To this end unnecessary lamps should be removed, lamps should be diligently extinguished when not needed, and inefficient lamps should be replaced with efficient lamps. The use of suitable reflectors, careful cleaning of lamps and reflectors, and the use of good light-reflecting surfaces are other means of effecting savings. Attempts to curtail artificial light otherwise than is here indicated are inadvisable. The relatively insignificant coal saving would be accomplished at the expense of diminished safety, reduced industrial output and liability to impairment of vision. It would become advisable only if the coal shortage became so acute that distinct impairment of the human energy of the country would be preferable to the use of the amount of coal involved.

Milwaukee School of Engineering Secures Prominent Engineer as Business Manager.—The School of Engineering of Milwaukee announces that Francis A. Vaughn, senior member of the consulting engineering firms of Vaughn & Meyer, of Milwaukee and Wausau, Wis., and Charles L. Pillsbury Company, Minneapolis and St. Paul, Minn., has been engaged by the School as business manager and director of engineering and industrial relations.

Commercial

House Wiring Results at Elmira—Public Service Company Conducting Appliance and Better Wiring Campaign

ELMIRA COMPANY SECURES 1465 HOUSE-WIRING CONTRACTS IN 1917.

The Elmira (N. Y.) Water, Light and Railroad Company concluded its year's house-wiring campaign on December 31 with a total of 1465 contracts to its credit. This was only 35 contracts less than the goal of 1500 which the sales department set for itself on the first of the year for 1917. The fact that this figure was so nearly realized in spite of the considerable reduction which has taken place in the size of the selling staff, is particularly noteworthy. If they could sign up 1465 contracts short-handed and in competition with Liberty Bonds, Red Cross campaigns, and all the other extraordinary expense of this year, undoubtedly they would have passed their goal long since had the year been a normal one. The result of this campaign is that 7500 out of the 10,000 homes in Elmira are now wired.

COMMISSIONS TO EMPLOYES TO AID APPLIANCE SALES.

Public Service Company of Northern Illinois Inaugurates New Sales Policy—Campaign On to Increase Outlets.

Under existing conditions, it behooves central stations to seek additional income from business that does not require capital investment. This may admirably be accomplished by more completely equipping the home with the many time and labor-saving appliances which have now really become necessities. In addition to the utility of electrical appliances, they are important factors in the conservation of fuel, food, labor and transportation and as such must appeal to the patriotic instincts of the prospective user.

The Public Service Company of Northern Illinois is actively pushing the sale of appliances and has enlisted the help of all of its employes by offering a commission of 5 per cent on all appliance sales made by employes other than those in the sales department. The company is publishing a bulletin which goes to each of its 2000 employes, describing the plan and calling attention to the more important appliances. This bulletin is 8 by 10 inches in size and printed on two sides. It will be published periodically and will give current prices on appliances and make timely suggestions to aid employes in their efforts to secure commissions. One side of the initial bulletin is shown herewith.

Rules Governing Payment of Commission to Employes.

The company's rules regarding payment of commissions are as follows:

(1) All employees are eligible to receive commissions except the following: Division superintendents, industrial gas salesmen, electric salesmen, electric power salesmen, sales clerks in salesrooms.

(2) Commencing February 1 and until further notice, a commission of 5 per cent will be paid to all employes, except those listed above, on retail sales of gas and electric appliances (except gas ranges, gas mantles, incandescent lamps, fans and auto charging outfits) for use in homes of customers of the company.

(3) Commission is payable as soon as the customer pays for the appliance, and in the case of deferred-payment sales as soon as the customer has made the second payment.

Commission will be paid monthly on or about the fifteenth of the month following the sale.

(4) The employe must obtain a signed order in duplicate from the customer. The employe must make sales during his spare time or after the company's regular business hours.

(5) Employes must create their own prospects and if they are unable to close the sale, they can, if they so desire, ask the division salesman for assistance and by mutual agreement divide the commission in such cases.

The order for the appliance signed by the customer should also bear the signature of the employe ents and assistant division superintendents, gas sales-

SALES BULLETIN

Issued by the Sales Department for the Sales Inspiration of Company Employes. Public Service Company of Northern Illinois, 72 W. Adams St., Chicago, Ill.

VOL. 1 FEBRUARY 15, 1918. NO. 1.

ANNOUNCEMENT OF NEW SALES POLICY

Company to Pay Commission on Sales

Ladies and Gentlemen:

Meet Mr. Incomebooster.

This energetic little man, whom you see at your left, represents a commission of 5%, which the Company will pay you on Gas and Electric Appliance Sales which you make. Now just a moment.

Don't all speak at once!

We know you are not in the Sales Department; and, that this is not a part of your work; and that your have had no experience in selling; and all that.

To begin with: It is not expected that you will neglect your regular duties to do sales work. This plan is based on the proposition that each one of our 2,000 employes has a certain number of friends, and neighbors, who are customers of the Company, and who they come in contact with from time to time.

If you will only take advantage of this opportunity to call their attention to one or more of the many gas and electric labor saving devices we have for sale, you will be surprised to see, "How easily a sale is made." And after each sale, Mr. Incomebooster will come across with the 5%.

Now as to Experience:

The best salesman that ever lived, began without experience. His experience came only after repeated effort. Who can say but that in our organization of 2,000 employes, there are many potential salesmen and saleswomen.

Now is your chance to demonstrate your, sales ability, and incidentally add to your bankroll.

Opportunity in the person of Mr. Incomebooster is knocking at your door. It is up to you to let him in.

Inspiration is more likely to strike a busy man than an idle one.

Hustle will get you more than horseshoes.

Don't wait for opportunity—Go after it.

THE ELECTRIC IRON

The electric iron is by far the most popular of all the electric labor saving devices found in the home today.

This fact is attested by the hundreds of thousands in daily use.

There were at least 7,000 electric irons, with an estimated income of $35,000.00, added to our lines during the past year.

Do you realize what it would mean if each of our 2,000 employes, exclusive of our selves, sold but five irons each during the present year? Not an impossibility by a long shot. Let's try it anyway. Suppose we fix upon this number, —Not as a goal but as a minimum of the number of electric irons we will sell during the present year.

You are all familiar with the electric iron; and will have no trouble in selling it. One terms of One Dollar down; and One Dollar per month, make it extremely easy for you.

The retail selling prices of electric irons are as follows:

Hotpoint—6 lb. iron, complete	$5.00
General Electric—6 lb. iron, complete	5.00
American Beauty—6½ lb. iron, complete	6.00

If the customer wishes, she can turn in, from one to four of her old style sad irons, and receive a Credit of 25c each on the purchase price of a new electric iron.

Or, if the customer wishes to turn in her old electric iron we will allow her a credit of $1.00 on the purchase price of a new electric iron.

This however, will not affect your commission, as you will receive commission based on the regular retail price of the iron.

Start your selling campaign with the electric iron, and after you find how easy they are to sell, you will have more confidence in trying the other appliances.

THE SALES BULLETIN

In the succeeding issues of the Sales Bulletin, which will be sent you from time to time, we will endeavor to furnish you, such information as will aid you in turning your prospects into sales.

The bulletin will contain short articles, descriptive of the gas and electric appliances we have to offer. Sales arguments, prices, terms, etc.

If you will save your copies of the bulletin you will soon have a volume of information for ready reference.

You will note that the bulletin is of the proper size to readily file in an ordinary letter-file.

It is important that you save your copies of the bulletin, as it will be impossible to supply you with duplicates.

Be a Live Wire and you won't get stepped on. It is only the dead ones that are used for door mats.

First Issue of Sales Bulletin for Employes Announcing Policy of Paying Commissions on Appliance Sales.

as commission will be paid only to the employe whose name appears on the order. Contracts secured by employes are to follow the same routine as at present. Appliances will not be placed on trial. Employes should sell only those appliances which in their opinion will be retained and paid for by the customer.

CAMPAIGN TO INCREASE NUMBER OF RECEPTACLES.

Another feature in the appliance campaign of the Public Service Company is a folder which is being sent to all residential customers dealing with the convenience of wall receptacles in using appliances. The company realizes that in many homes the lack of outlets has been a serious detriment to the use of appliances. This is particularly true in the kitchen and dining room where most appliances are ordinarily used and many families already owning appliances hesitate to use them because of the trouble involved in removing the lamp, installing the appliances and then returning the lamp to its place. At night when the lamp is in use, appliances can seldom be used where such conditions prevail.

The Public Service Company is offering to install wall or floor receptacles in houses already wired on a partial-payment plan as follows:

Where amount is less than $6, cash in 30 days.

Where amount is $6 to $12, six equal monthly payments.

Where amount is $12 or over, twelve equal monthly payments.

The folder is attractively printed in two colors and is entitled, "More Time to Knit." The following extracts from the text indicate the advantages of a sufficient number of receptacles.

"Are you getting the maximum of service from your electrical appliances? Are you depriving yourself of the comfort and convenience which you thought they would bring when you bought them, because you do not have a convenient place to attach them?

"With electricity in your home you have an electric servant, ready at your beck and call at any time of the day or night to relieve you of most of your household tasks.

"If you are not getting the full benefit of this service from your electrical appliances because of a lack of convenient attachment sockets in your home, you will be interested to know that there is an easy way to install a few more receptacles at convenient places about the house.

"These receptacles can be located in a wall, baseboard, floor or in the side of the dining room table. These outlets will do away with the overhead cord and the necessity of removing the lamp every time you wish to use an electrical appliance. A few of these receptacles about the house will enable you to use your appliance to the best advantage, permitting you to realize the electrical ideal of comfort and convenience."

A postal card is sent with the folder, requesting the company to have a representative call and furnish an estimate of the cost of installing the receptacles desired. The folder was prepared for the company by Harvey Hubbell, Inc., but bears no advertising of the Hubbell Company.

More Outlets—More Service

ONE of the premier advantages of electrical appliances is the convenience with which they can be used. A liberal supply of wall receptacles in the home adds materially to this convenience, and enables you to get the maximum service from your electrical appliances.

These receptacles can be either single or duplex. They are set flush with the wall and can be installed without marring the woodwork, or disturbing the decorations in any way.

It is often desirable to operate two electrical devices simultaneously, such as the Electric Percolator and the Electric Toaster, or the Electric Iron and Fan. This can be done with the use of the duplex receptacle, as there are two outlets on the same plate. Full current is supplied from each outlet as the connections are independent of each other.

Multiply Your Comforts By Installing More Outlets

EVERY additional outlet means more comfort and convenience and less work. Your health and comfort are worth many times the small cost of the installation.

In order to enable everyone to modernize his home by the installation of an adequate number of baseboard outlets or wall receptacles, we will, for a limited time, wire for additional outlets for appliances under the following easy terms of payment:

Where the amount is less than $6.00—Cash thirty days.
Where the amount is $6.00 to $12.00—Six equal monthly payments.
Where the amount is $12.00 or over—Twelve equal monthly payments.

If you will sign and mail the enclosed card, we will be pleased to have our representative call and furnish you an estimate on the cost of installing one or more of these additional outlets. This will place you under no obligation, and will enable you to learn how reasonably this work can be done.

PUBLIC SERVICE COMPANY
OF NORTHERN ILLINOIS

Inside Pages of a Folder Sent by Public Service Company of Northern Illinois to All of Its Residence Customers.

Operating

Condensation Cause Flashover—Overcoming Meter Inaccuracies—Costs of Shutdown—March Street Lighting Schedule

CONDENSATION ON ROOF CAUSES FLASHOVER.

A Low Roof, Steam and Cold Combine to Cause Peculiar Rotary Trouble.

By L. M. Bergman.

It might seem a long step from the topic of roof design to that of flashing-over of rotary converters. And yet the design of a roof in one instance interferred seriously with the performance of a rotary installed beneath it.

The rotary converter was installed in the engine room of a plant containing three 3000-kilowatt turbo-generators and a number of smaller machines and steam-driven auxiliaries. This rotary was used to supply excitation to the generators and also energy for some smaller motors such as sump pumps, boiler-room auxiliaries, etc., and was installed apart from the balance of apparatus in the station, having been installed only as a temporary measure.

For several months after first being installed the rotary operated without any trouble, as it should, since the load was constant and steady at about normal. However, at a different time the unit started to give trouble, for no apparent reason. Whereas before it had run from dawn to midnight without sparking or flash-over it suddenly started to splutter and spark and frequently flash-over within a short time after having been started up in the morning. Operating conditions were apparently identical before and during the trouble, and yet there appeared no apparent cause.

The trouble started one day, about ten minutes after starting up. The machine gave a splutter, and almost flashed over between the upper brush holders. The next morning it did the same thing, but this time caused such a commotion that the generator it was exciting fell out of synchronism with the other generators. The unit was then shut down and the commutator and brushes cleaned up. But there was still no indication of the cause; in fact, it was difficult to say whether the rotary or the generator started the trouble.

For several days nothing happened and the previous incidents had been almost forgotten, when one morning the machine arced over and shut itself and one generator down. The most simple explanation would be that the rotary was somewhat unstable, due to the fact that it was installed in the same station as the generators and near them, thus having low reactance between its terminals and the generators, for reactance is an important factor toward stable operation. Another reason might be that the resistance between generator and rotary was too high, as high resistance tends to reduce stability whilst reactance tends to improve it. However, the fact that the rotary had been operating since the summer satisfactorily discounted these theories as nothing had been changed in the station. The weather outside had changed, however, and, moreover, it was with the coming of cold weather that the trouble started.

What had actually happened was this: The steam from the engine room proper had entered the section containing the rotary converter a short time previous to starting up, and condensed on the glass skylight when the weather was cold. The condensate collected and slowly trickled down the glass until finally the quantity of water accumulated became so great as to fall. And it fell upon the commutator of the converter below. The roof was rather low, which explains why the trouble only occurred in the morning when the rotary was started up. The air was then cold and still. When the rotary was running its armature acted as a fan to circulate the air in the room and at the same time warmed it. This warm air was driven up against the glass and heated it sufficiently to prevent condensation of steam upon it. There was no water to fall down on the commutator after the rotary had been running a short time, and after that which had already formed with the starting up of the generator has formed and fallen.

The remedy was a simple one, once the cause of the trouble was known, namely, to improve the ventilation around the roof so that what condensate otherwise would occur might evaporate instead of collect.

OVERCOMING METER INACCURACIES OF OUTDOOR INSTALLATIONS.

By B. E. Smith.

When the outdoor substation first came into usage and meters were installed outdoors, inaccuracies in metering occurred that became a source of trouble and annoyance, in some cases necessitating seasonal calibration of the meters. The trouble was due, of course, to climatic changes and occurred in those climates where the temperatures changed radically.

Since the first installations, many developments have been made and today errors due to temperature changes have been almost if not entirely overcome by adopting suitable housing for the meters. Today, instead of meters being installed in ordinary wooden or steel boxes, as was done at first, where weather conditions require, special construction is employed to make the meters as immune as possible from outside influences. Some of the manufacturers of electrical apparatus make the housing for their own equipment and market the outfit complete. However, many companies prefer to construct their own, as they need them and how they want them.

In making these metering housings two things have to be guarded against so far as metering errors are concerned, namely, temperature changes and moisture due to condensation. For uniform internal tempera-

tures ample space is better than too little, and in some instances an electric lamp of 25 to 40 watts has been used during the colder seasons of the year to keep the interior of the metering house warm and at approximately uniform temperature. Double walls are often employed for the housing, with an intervening space between in which felt is inserted, although an air space may frequently suffice in the milder climes. The aim is, of course, to have fairly uniform temperature within the meter housing during day and night, and from season to season. If this cannot be entirely obtained but only very approximatelv, it is not difficult to calibrate the meter semi-annually to take care of climatic changes. Where the customer is an important one a semi-annual or perhaps a quarterly meter check would be made in any case, and it is during these that data may be obtained as to how far it is worth while to go toward making the meter housing immune from the weather changes.

While uniform internal temperature is important, absence of dust, dirt and moisture are also important, perhaps more so. The structure with double walls for maintaining uniform temperatures also acts to eliminate moisture, that is condensation. Condensation has in the past caused quite a deal of trouble with metal structures, but is not a factor with wooden structures. Where wooden housings are used watertight and dust-proof seams should be used. Where metal is employed it should be borne in mind that the method of clamping the meters may enable the outside cold to be transmitted through the clamping bolts unless precautions are taken.

No mention has been made of insects, because a housing that will keep out moisture and maintain nearly uniform internal temperature will also keep out insects. It should be remembered, however, in connection with the use of wooden structures that insects may eat their way in, especially in certain localities. Moreover, wooden structures are not fireproof and are comparatively susceptible to interference by insects, animals and men. The metallic meter housing, although usually slightly more expensive than a wooden one is fireproof, safer and more permanent and preferable in every way. The metallic housing should be connected to all metallic parts of equipment and all well grounded.

BALANCING COST OF SHUTDOWN AGAINST LOSS DUE TO DECREASING OPERATING EFFICIENCY.

Did you ever stop to figure what it costs to take out of service a large and efficient machine, perhaps the largest and most efficient in the station, and carry its load on other smaller, less efficient units? Further, do you know when it pays to incur such a loss, but by so doing save money, because the large unit is decreasing in efficiency due to various causes? Do you know the efficiency of every unit in the station, and the cost of operating it upon unit basis? Do you know to what extent individual efficiency of condenser, turbine blading, boiler and feed-water heating surfaces, etc., decrease each week or month, or semi-annually, due to erosion, scale and dirt? Do you know how long it takes and what it costs to clean and replace dirty and defective condenser tubes, and when it pays to do so rather than continue with decreased and continually decreasing efficiency? Have you ever equated the cost of cleaning and lost capacity on the one hand against the expense of keeping in service a unit that is less efficient than it might be were it cleaned and overhauled on the other?

Do you know these things? If not you do not know how to maintain the over-all efficiency of your station at its maximum efficiency with a minimum of expense, and it is very probable that you are not operating as economically as you otherwise could, how can you ask for higher rates, when you are not giving the best service at lowest expense? Find out your losses, determine their magnitude, and then decide which can be eliminated with economy.

Coal Saving by "Daylight Saving" Plan.—In commenting on the possible saving in coal to utilities by the adoption of the "daylight saving" plan advocated by Samuel Insull, president of the Commonwealth Edison Company, Chicago, it was stated in our issue of February 9 that 230,000,000 tons of coal would be saved. This figure is, of course, in error and should have been 230,000 tons.

Street Lighting Schedules for March.

War-time economy is being exercised in every branch of electric service, including street lighting. To prevent the latter from suffering when economy is carried too far, that is, to the point of parsimony, it is necessary to follow a reliable lighting schedule. Two such schedules—the well known all-night and the Philadelphia moonlight schedules—are given herewith for next month. The time is given to the nearest five-minute division of mean local solar time and the table is compiled for latitude 40° north.

MARCH, 1918.

Night of March	All-Night Schedule		Moonlight Schedule	
	Light	Extinguish	Light	Extinguish
1.....	**6:20**	6:05	**6:20**	**10:35**
2.....	**6:20**	6:00	**6:20**	**11:35**
3.....	**6:25**	6:00	**6:25**	12:35
4.....	**6:25**	6:00	**6:25**	1:35
5.....	**6:25**	5:55	**6:25**	2:30
6.....	**6:25**	5:55	**6:25**	3:25
7.....	**6:30**	5:55	**6:30**	4:10
8.....	**6:30**	5:55	**6:30**	4:55
9.....	**6:30**	5:50	**6:30**	5:20
10.....	**6:30**	5:50	**6:30**	5:20
11.....	**6:30**	5:50	**6:30**	5:20
12.....	**6:35**	5:45	**6:35**	5:15
13.....	**6:35**	5:45	**6:35**	5:15
14.....	**6:35**	5:45	**7:35**	5:15
15.....	**6:35**	5:40	**8:50**	5:10
16.....	**6:35**	5:40	**10:00**	5:10
17.....	**6:40**	5:40	**11:05**	5:10
18.....	**6:40**	5:35	12:05	5:05
19.....	**6:40**	5:35	12:55	5:05
20.....	**6:40**	5:35	1:35	5:05
21.....	**6:40**	5:30	2:15	5:00
22.....	**6:45**	5:30	2:45	5:00
23.....	**6:45**	5:30	3:10	5:00
24.....	**6:45**	5:25	3:35	4:55
25.....	**6:45**	5:25	No light	
26.....	**6:45**	5:25	No light	
27.....	**6:50**	5:20	No light	
28.....	**6:50**	5:20	**6:50**	**8:25**
29.....	**6:50**	5:20	**6:50**	**9:25**
30.....	**6:50**	5:15	**6:50**	**10:25**
31.....	**6:50**	5:15	**6:50**	**11:25**

Tables for each month of the year, rules for the two schedules given above and for modifications of them, corrections for standard time and latitude, monthly and yearly total hours of burning for the five most common schedules, as well as other information pertinent to the subject, are printed in a booklet obtainable from the Electrical Review for 25 cents a copy.

Contracting-Construction

Final Article of Croft's Comments on Conduit Bending—Electrical Work Under Way and Other Contractors' Doings

METHODS OF BENDING CONDUIT.

Seventh of a Series of Articles Describing the Best Practice.

BY TERRELL CROFT.

In Forming Uniform Double Bends a rack constructed as detailed in Fig. 37 can be used to advantage. Often in industrial-plant buildings it is necessary that many lengths of conduit have double bends formed in them where the runs pass around a pilaster, as for example in Fig. 38. A common case of this kind is along the walls of a machine shop where benchwork is done along the outer walls and outlets for bracket lamps or connection of soldering irons or

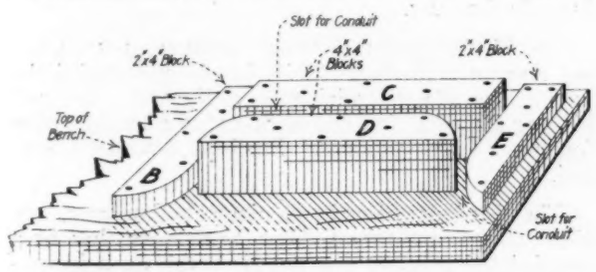


Fig. 37.—Perspective View of Simple Form for Making Uniform Double Bends.

other portable electric tools must be provided; in this case the pilasters are of uniform width, so that a convenient means of making numerous double bends is desirable. If a rack like that of Fig. 37 is constructed, such bends can be completed with minimum expenditure of time and labor. Fig. 39 details the dimensions for a rack for forming the double bend required in Fig. 38. The blocks *C* and *D* (Figs. 37 and 39)

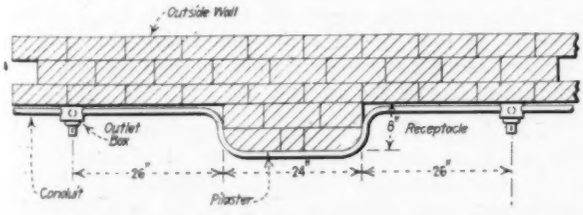


Fig. 38.—Plan of Double Bend in Conduit Around a Pilaster.

are pieces of 4 by 4, while *B* and *E* are cut from lengths of 2 by 4 sticks. These blocks can be attached to the top of the work bench. The lower ends of *B* and *E* are rounded off, as suggested, to the curvature of the required bends and two corners of *D* are similarly formed. Block *A* constitutes a stop and it is nailed to the top in line with the groove between *C* and *D* at a distance *L* from the main part of the form. The process in forming the double bend is as follows:

Place the conduit in the groove between blocks *C* and *D* (Fig. 40) so that when the bend is completed the left end *X* of the pipe will extend into its outlet box just the right distance. Thereby the cutting off of this end of the pipe is avoided. After this location

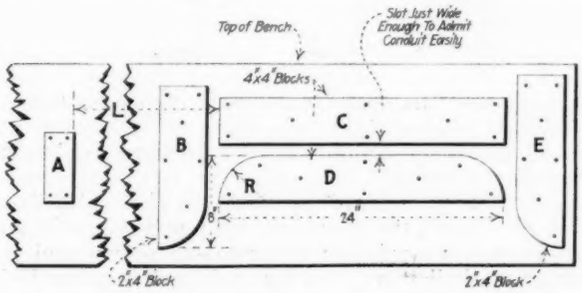


Fig. 39.—Plan View of Form for Making Double Bends.

has once been determined, the block *A* is nailed to the bench top, which renders a second determination unnecessary. The other end *Y* of the pipe is then bent around the form as shown in Fig. 40. Next reverse the conduit (Fig. 41) so that the *Y* end extends between *B* and *D* and the *X* end projects over *E*. Now bend the *X* end around *D* (Fig. 42). Finally the hickey or a bending sleeve is engaged successively on

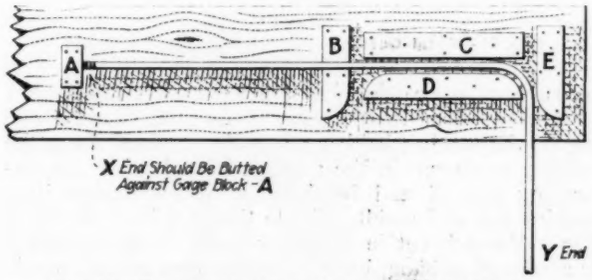


Fig. 40.—First Operation in Forming a Double Bend.

the *X* end and the *Y* end of the pipe and it is bent into the form detailed in Fig. 43. To complete the tube the *Y* end is cut off to the correct length and threaded. By following this plan the entire work is finished quickly, all bends are uniform and waste of conduit is prevented. Although it does not take long to make and arrange the blocks, using material found

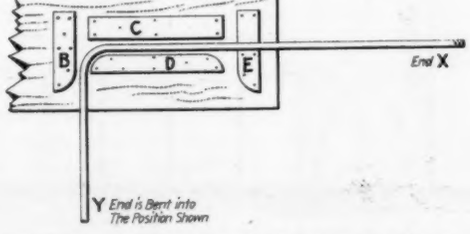


Fig. 41.—Second Operation in Forming Double Bend.

on the job, it may in some cases be desirable to use the rounded blocks over and over. Block *D* may be made in two parts with a gap between them to permit of different longitudinal lengths of offset. The blocks

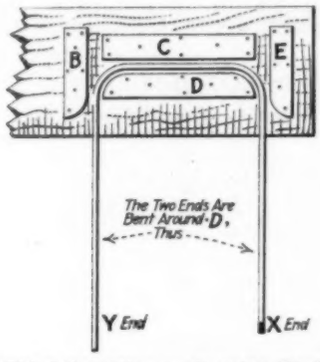


Fig. 42.—Third Operation in Forming Double Bend.

B and *E* may be moved back or forward to change the offset distance.

In Forming a Bend so That the Extending Leg Will Be Plumb, the expedient diagrammed in Fig. 44 has been employed In the example shown and in numerous similar cases, an exposed conduit is installed on a side wall close to the ceiling and its extending end *E* should be bent so as to extend vertically downward. Inasmuch as the ceiling of a room is not always at right angles to a plumb line, the workman cannot

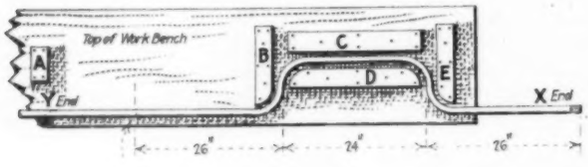


Fig. 43.—Final Operation in Forming Double Bends.

be sure of a neat-looking job by merely forming a 90-degree elbow in the pipe. However, if with one leg of the conduit held temporarily in place along the ceiling, as shown in the picture, he "plumbs" the extending end *E* and bends it to fit, a businesslike-looking job will result. To do this, a 2 by 4 timber *T* has a V-notch cut in its upper end. A plumb bob *P* is arranged to hang down from the apex of this notch. In using the device the timber is braced in position as shown and the wireman can then determine whether

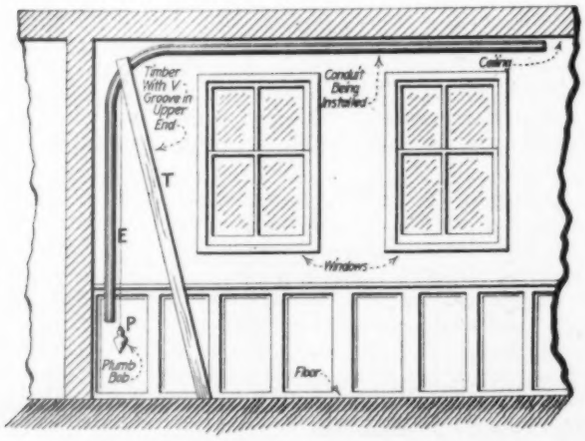


Fig. 44.—Method of Making a Vertical Run Plumb.

or not the extending end *E* of the conduit hangs plumb. If it does not, it can be easily rebent accordingly.

(The End.)

AMONG THE CONTRACTORS.

The Bothwell Electric Company, of Youngstown, Ohio, has under way the wiring of the Liberty Theater at West Federal and Hazel Streets, Youngstown. About 1,000 lights are to be provided for.

Ellsworth Scott, of Cleveland, Ohio, has received the contract for the electrical work in seven two-family residences totaling $50,000 in cost that are being erected in Cleveland Heights for S. Grenka.

The Pfahl Electric Company, 3074 East 25th Street, Cleveland, Ohio, has been awarded the contract for electric wiring in a $15,000 private garage being built at 2340 Holmden Avenue, Cleveland, Ohio, for S. W. Mather.

The G. A. Webster Electric Company, Youngstown, Ohio, has received the contract for installing wiring for 850 outlets in the new addition to the building of G. M. McKelvey & Company, in West Federal Street in that city.

The F. M. Grant Electric Company, 1518 Prospect Avenue, Cleveland, Ohio, has been awarded the contract for electric wiring in a $50,000 office and shipping building for the Kirk-Latty Manufacturing Company, 84th Street and Madison Avenue, Cleveland.

The Jandous Electric Equipment Company, 109 West Thirty-first Street, New York City, has been awarded the contract for the electrical work in connection with the new four-story addition to the Brooklyn State Hospital, Brooklyn, which is being constructed at a cost of $325,000.

The Bland Electric Company, general contractor of Louisville, Ky., has received an excellent Government contract for installation of electric work for the large port terminals, warehouses, etc., to be erected by the Government at Newark, N. J. The Bland Company handled a portion of the electric installations at Camp Zachary Taylor, near Louisville, and also handled the electric installations at Lake Charles, La., the Federal aviation camp. J. O. Bland, head of the company, is now in Newark, completing the details. The local office has received only meager reports concerning the size of the work.

The Home Electric Construction Company, with main office in the Gamage Building at Macomb, Ill., and branch stores at Macomb, Bushnell, Rushville, Beardstown and Havana, Ill., at its stockholders' meeting the other day changed its corporate name to Live Wire Supply Company and elected the following officers: W. I. Savidge, president; F. W. Weber, vice president; Wm. I. Knowles, secretary; George Rippetoe, treasurer and general manager. The company expects to double its business this year. The business of the company has been steadily increasing and covers a wide territory in Illinois. It was incorporated in 1911 as The Home Electric Construction Company and conducts a general electrical contracting and electrical merchandising and supply business. The members of the firm have long been "live wires" in fact as well as now also in name.

New Appliances

Fixture Hanger for Old Work—Chaingrip Pipe Vise—New Compensarc Set—Thomas Gas Meter—Flota Mica Lubricant

FIXTURE HANGER FOR OLD-HOUSE WIRING.

In wiring old houses it is desirable to have a convenient and reliable means of mounting ceiling fixtures without ripping up more plaster at the outlet than is absolutely necessary. A strong and easily installed hanger for greatly facilitating fixture wiring in such premises has recently been invented by an experienced electrical engineer in Chicago and is being marketed by the well known jobbing house of M. B. Austin & Company, 700 Jackson Boulevard, Chicago, Ill. It is shown in the accompanying illustrations as applied to an already finished building of the usual

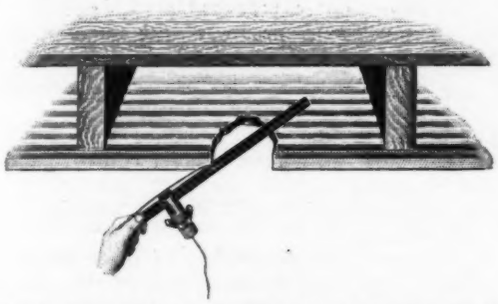


Fig. 1.—Inserting the Hanger Into the Ceiling Outlet.

wood joist floor and lathed ceiling construction. It is equally serviceable, however, for changing ceiling outlets in buildings with tile construction.

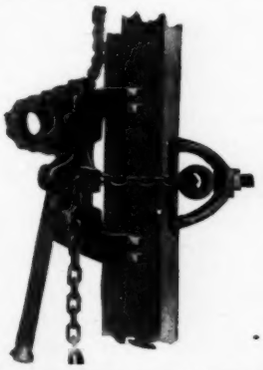
This hanger consists of a substantial bar on which is adjustably mounted the fixture stud with locknut. Fig. 1 shows the hanger being inserted through the plaster hole after the stud has been slipped to the end of the bar. The latter is then held horizontal and a wire leader, which runs from the end of the bar to the center and then down through the stud, is pulled down. This slides the bar into position and centers the stud, so that the combination occupies the position shown in Fig. 2. The bar is flat and will not tear through the plaster. Its length is such that it distributes the load over many laths. A special locknut is provided for each stud to lock the outlet box or ceiling plate firmly in position. This hanger should be the means of saving much time and trouble in wiring or rewiring old buildings.

Fig. 2.—Hanger in Place and Ready for Wiring and Fixture Hanging.

THE CHAINGRIP CONDUIT OR PIPE VISE.

In these days of labor shortage combined with frequent need for carrying on rush work, every means for enabling a man to do his work more quickly or conveniently is of immediate value. In electrical contracting and maintenance work, the growing use of conduit requires a readily portable pipe vise so that conduit may be easily threaded or cut to suit any changes found necessary where it is actually installed. Likewise, in a large power house the large amount of piping frequently calls for quick repairs or changes which would involve much lost time if it were necessary to go back to the permanent bench vise usually provided in the tool room or machine shop of a well equipped plant.

The Chaingrip pipe vise illustrated herewith is a simple, portable vise, which can be moved from one location and mounted at another in a moment's time. It eliminates long walks to the distant bench vise by always being right at hand. It fastens to any kind of a horizontal or vertical support, whether round, square or flat, without the use of bolts. It locks any size pipe or conduit within its limits, by the slight push of a



Chaingrip Mounted on Corner of a Wood, Iron or Concrete Upright and Locked, Securely Holding Pipe.

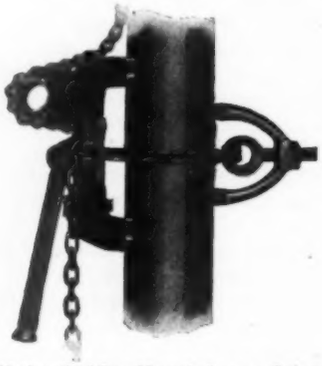
lever. No previous adjustment is necessary. Hence it saves labor and effort.

The base support of the Chaingrip is squared out in the form of an inverted V, at the sides of which are bolt lug feet, to be used only in case the vise is to be permanently bolted in one position. Hence it will readily conform to a round, square or flat surface. A clamp support on the opposite side of the column is a part of the Chaingrip equipment. It has a bell-section shape, having a boss at the top, through which a threaded supporting eyebolt passes freely. A heavy nut resting on the top of the boss, and engaging the threaded eyebolt, adjusts the tension of the chain passing through the eye of this bolt. The base of the clamp support is squared out in a manner similar to the vise base, in such a way that it fits the same shaped surfaces.

A heavy wrought-iron chain is riveted on one side

of the vise base. It passes around the supporting column, through the eye of the eyebolt in the clamp support, and thence to the other side of the vise base, a link being held securely in position in a socket. Tightening of the eyebolt nut tightens the supporting chain and holds the vise rigidly in position. Loosening this nut permits the vise to be removed in a moment.

The Chaingrip vise locks a pipe or conduit firmly between a double set of steel pipe jaws on one side, and a heavy, close-linked steel chain on the other. The locking motion is accomplished by the movement of the handle toward the vise. This handle fulcrums on a steel pin, which projects through two bosses, one on either side of the frame of the vise. Directly beneath this fulcrum point the handle takes the shape of a cam, which in turn operates against a movable horizontal bar. To one end of this bar is riveted the steel grip-



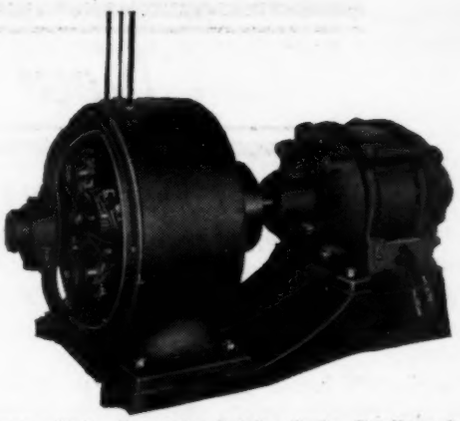
Side View of Chaingrip Vise Mounted on a Column and Locked.

ping chain which passes around the pipe or conduit, and locks in a steel socket. The other end, or fulcrum point, of the bar is supported by a threaded bolt, the enlarged knurled head of which rests upon a boss on the base of the vise. Rotation of the head of the bolt raises or lowers the fulcrum point of the bar and forms an adjustment of pressure exerted by the other end of the bar on the gripping chain when the handle of the vise is in a locked position, that is, when it is at the end of its travel toward the vise, and the largest radius of the cam is directly beneath the fulcrum point of the handle support. Pulling out the handle instantly unlocks the conduit or pipe, which can be pulled out sideways or upward if the chain is unhooked.

Every part of the Chaingrip is carefully designed for maximum stress. Heavy malleable-iron castings form the base and clamp support. Open-hearth steel is used in the jaws, grip-chain socket and grip chain. Each Chaingrip vise is packed separately in a neat, strong box. An attractive label immediately identifies the size of the vise. Two sizes are made; the No. 1 is suitable for pipe ranging from ⅛ to 2½-inch size; No. 2 takes any pipe from ¼ to 4½-inch size. These two sizes of vise weigh 17 and 22 pounds, respectively. The Gerolo Manufacturing Company, Old Colony Building, Chicago, Ill., is the manufacturer of this labor and time-saving device.

COMPENSARC SET FOR CHANGING ALTERNATEING TO DIRECT CURRENT FOR PICTURE PROJECTING.

The General Electric Company, Schenectady, N. Y., has recently developed an alternating-current to direct-current Compensarc equipment which permits series operation of two arc-type projection lamps



Compensarc Motor-Generator Set for Series Feeding of Direct-Current Projecting Lamps From Alternating-Current Lines.

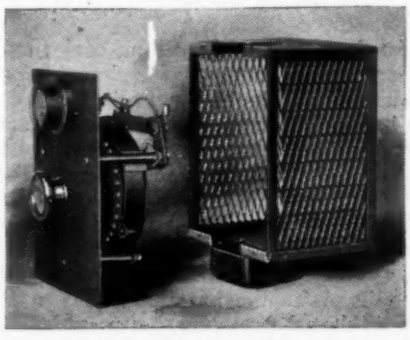
while projection is being changed from one lamp to the other.

This Compensarc is known as the series type for obvious reasons and is illustrated herewith. It is made in capacities of 35, 50 and 70 amperes, for all standard alternating-current circuits and can be used in the big majority of installations.

Series operation was desirable to simplify wiring and to save energy by eliminating the steady resistance in series with each arc lamp, found necessary with previous methods where lamps were connected in parallel across the generator armature.

The complete equipment includes the Compensarc motor-generator set, a steel-cabinet control panel and a short-circuiting switch for each projection lamp. The 50 and 70-ampere outfits have in addition a starting compensator.

As shown in the illustration of the cabinet panel, the ammeter, the field rheostat, and all the wiring are



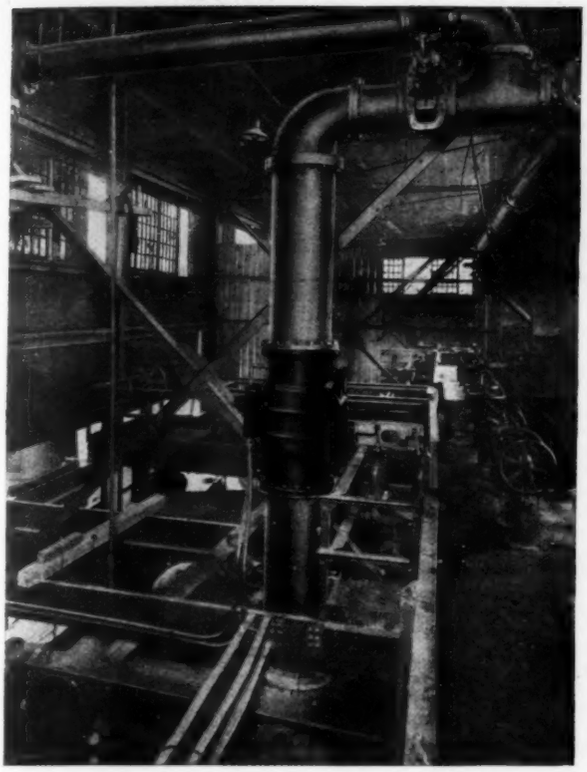
Control Panel and Protected Cabinet for New Compensarc Set.

mounted on the panel of the cabinet, which is removable for mounting and for attention. Wiring may be either from the top or the bottom.

Simple control is attained through the elimination of steadying resistance, use of few parts and compact arrangement, minimizing the technical knowledge necessary to successfully operate the service.

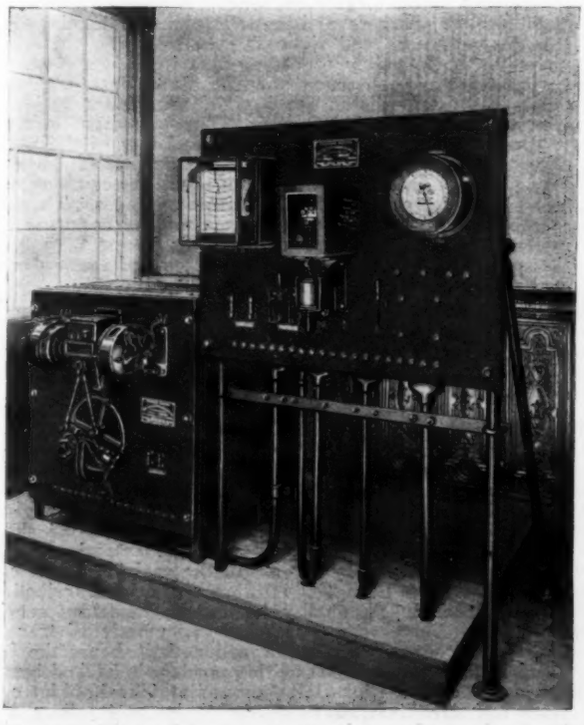
THOMAS METER FOR MEASURING GAS IN STEEL MILLS.

Increasing quantities of surplus gas from by-product coke-oven plants are being consumed in various processes in steel mills and it is desirable to have an accurate and reliable measurement of this gas. For



Thomas Meter Housing Located at Convenient Point in the Gas Line Just After It Enters the Soaking-Pit Building.

this purpose, the Thomas meter has been applied, which measures the quantity of gas in standard units, such as cubic feet, without any calculations or corrections for pressure and temperature, although these may vary through wide ranges. The total quantities (in cubic feet) are shown on an integrating meter



Recording Meter Panel Located in Office of Superintendent.

and the rate of flow is shown graphically on a curve-drawing instrument.

The meter is installed in a housing which replaces a portion of the gas pipe line, as shown in one of the accompanying installation views. The principle of the Thomas meter is that it measures the heat capacity of a gas electrically. The amount of electric heat necessary to raise a standard unit two degrees is used as a measure of the gas flowing through the meter. The electricity for heating the gas can be conducted on comparatively small wires, consequently the meters showing the amount of gas used can be placed in the superintendent's office or other desired location, which may be several hundred feet from the meter proper. The recording panel is shown in one of the illustrations as installed in the office of the rolling-mill superintendent of the Brier Hill Steel Company, Youngstown, Ohio. The graphic chart shows him at a glance just how much gas is being used at any time in the steel mill. The complete Thomas meter and recording panels are made and installed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

FLOTA MICA—A LUBRICANT TO BE MIXED WITH OIL OR GREASE.

War imposes the elimination of all wastes not brought about by military necessity and this means that waste of power due to inefficient lubrication or lack of lubrication cannot be tolerated. It has long been known that the lubrication of many bearings, cylinders and other wearing parts subjected to heat is effected imperfectly by the ordinary oils and greases.

Such a mineral has been used as the base for a lubricating compound known as Flota Mica. It is a fine white powder of superior lubricating qualities. Its chief constituent is finely ground mica, whose lubricating qualities have long been known. The principal obstacle found in the use of mica as a lubricant heretofore has been the difficulty of grinding it sufficiently fine. A method of pulverizing has been developed, however, which enables the mica to be ground so finely that it will remain permanently in suspension when mixed with certain other ingredients.

In using Flota Mica it is mixed in small proportions with oil or grease, these materials serving the double purpose of lubricant carriers for the Flota Mica. The excellent lubricating properties of this material thus make possible the satisfactory use of low-priced oils and greases. This material has the advantage of being equally suitable for use in the heaviest machinery or the most delicate mechanisms. If directions are accurately followed, it can be used in all kinds of lubricators and feed cups and will not fill up the finest oil grooves nor does it cake, harden or slag or become gummy.

It reduces friction to a minimum by filling up all the tiny depressions existing in the surfaces of contact. It virtually brings about refinishing of the metal surfaces, which when so treated possess a mirror-like polish.

This material is especially suitable for bearings that ordinarily run hot, thus avoiding the troubles of "hot boxes" which so readily develop in such cases. It is used very successfully in engine and air-compressor cylinders, automobiles, high-speed motors, etc.

It is put up in 5, 10 and 20-pound cans and marketed by the Flota Mica Sales Company, Moffat Building, Detroit, Mich.

Trade Activities

Cumberland Electric Manufacturing Reorganized—Manufacturers Appoint Sales Representatives—Catalogs Distributed

New York Gas & Electric Appliance Company, with offices and display rooms located at 569-571 Broadway, New York City, has changed its name to the Lightolier Company, effective February 15. All goods manufactured by this company will be sold under the registered trademark of Lightoliers.

The Davis Slate & Manufacturing Company, Chicago, millers of electrical slate, is distributing a serviceable wall calendar. The calendar shows three months, the current month and the months preceding and following. It is artistically gotten up and will be found useful as well as ornamental in any office.

Correction.—Through an oversight there was published in this section in the last issue a note in which occurred the statement "the Trico renewable type fuse, which has lately been approved by the National Board of Fire Underwriters." This note was published exactly as it was sent to us by the Gilpin V. C. Company, 50 Columbia Heights, Brooklyn, N. Y.; it announced the removal of its offices and gave a list of the principal products that the firm handles. We are informed that the fuses in question have not been approved as was alleged and that the report on their test has not yet even been promulgated by the Underwriters' Laboratories.

Schweitzer & Conrad, Inc., Chicago, Ill., announce the appointment of the Franklin Sales Company, First National Bank building, Denver, Colo., as their district representative for the states of Wyoming, Colorado, New Mexico, Arizona, Utah, the western portion of Nebraska, and the eastern parts of Montana and Idaho. The Franklin Sales Company in this territory will handle the entire line of S&C protective and switching devices, which consists of the following: high-voltage fuses, fuse mountings, fused switches, lightning arresters, high-voltage di-electric liquid, portable high-voltage and disconnecting switches, choke coils, special relays, voltage detectors, and recording synchroscopes.

Cumberland Electric Manufacturing Company, Memphis, Tenn., has been reorganized and incorporated under the laws of Tennessee with a capital stock of $6,000. William M. Nelson, H. A. Beckham, E. L. Nelson, J. S. Nelson and William C. Burton are the incorporators and the concern in the future will be known as the Cumberland Electric Manufacturing Company, Inc. The main office and factory of the company will be located at Memphis, Tenn., and business will be conducted along the same lines as heretofore, continuing its well known line of Imperial bell-ringing transformers, special and toy transformers, and will shortly place on the market a line of electric flat irons, attachment plugs and magneto lamp regulators for Ford cars.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued an 8-page booklet, known as Booklet W, illustrating and describing the C-H Dispatch Conveyor, which is particularly adapted for newspaper and magazine publishing plants. It is designed for taking papers from the press, regardless of the press speed, and delivering the folded papers in the mailing room. The booklet also gives a list of representative papers using the C-H Dispatch Conveyor, among which are the following: New York Evening Mail, New York Sun, New York Times, Philadelphia Bulletin, Philadelphia Inquirer, Philadelphia Ledger, Christian Science Monitor (Boston), Pittsburgh Dispatch, Cleveland Press, Detroit News, St. Paul Dispatch, Knoxville Sentinel, Birmingham News, Syracuse Herald, Lexington Herald, Des Moines Register Tribune, Burlington (Vermont) Free Press, Sydney Herald, Sidney, Australia. One of the latest installations is that for the Detroit News, which is considered to have one of the most modern press rooms in the country. The flexibility of this dispatch conveyor permits turning at any angle, vertical or horizontal, to avoid obstructions. It may be run overhead, down through the floor or straight away.

Cooper Hewitt Electric Company, Hoboken, N. J., has removed its Cincinnati office into larger quarters located at 1406 First National building, of that city. George W. Walker, who has been associated with the company for the last ten years, continues as district sales manager.

Dayton Fan & Motor Company's plant, located at Ludlow and Bayard streets, Dayton, Ohio, was damaged by fire recently, entailing a loss of $30,000. W. F. Phillips, president of the company, states that arrangements for the rebuilding will be taken up at once.

The Esterline Company, Indianapolis, Ind., manufacturer of graphic electrical instruments, pressure, speed and vacuum recording instruments, announces the appointment of the Northern Electric Company, whose main office is located at Montreal, Canada, as exclusive distributor of Esterline products for the entire Dominion of Canada. The following named offices of the Northern Electric Company will handle the Esterline product and will be in a position to give complete information and service on this line: Montreal, Halifax, Ottawa, Toronto, London, Winnipeg, Regina, Calgary, Vancouver.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has removed the manufacturing operations of its automobile equipment department to its Newark works, located at Plane and Orange streets, Newark, N. J. At these works the Westinghouse company has for many years been manufacturing small motors and instruments of accuracy and precision. Its facilities and staff assure a continuation of the present high quality of the automotive equipments. The general sales offices of this department have also been moved to 110 West Forty-second street, New York City, where the Eastern district sales office will also be located.

Bridgeport Brass Company, Bridgeport, Conn., as stated in a recent issue of the ELECTRICAL REVIEW, was one of the first companies to inaugurate a plan of group life insurance for workers of industrial plants, including benefits for accidents and sickness. In outlining this company's splendid policy regarding this insurance plan, the details were misconstrued and the statement made that there was no provision for loss of time from accidents occurring outside of the factory. This statement referred to the provision of the Compensation Laws of the State, and not the company's plan. The company's insurance plan provides for loss of time from accident occurring outside of the factory and for loss from sickness. Through these two provisions every employe of the company, no matter how he is injured or what his illness may be is taken care of during the whole 24 hours of every day in every week.

Link-Belt Company, with main offices in Philadelphia, Chicago and Indianapolis, and branch offices in the principal cities of the United States, is distributing Book No. 359 on "Chain Driven Motor Trucks and Tractors," which is the address of Harold S. Pierce, delivered at a Truck Sales Conference in New York City. Mr. Pierce, in the booklet, tells of the positive and unquestioned advantages of a chain-driven truck or tractor over gear-driven types of all characters. Several important facts regarding this drive are presented, principally those involving the higher mechanical efficiency, less unsprung weight for a given strength, a semi-elastic medium between the road shock and the more delicate driving part, concentration of the bulk of the wear in the chain and the variable wheel centers. The Link-Belt "TT" roller chain is described as being of the highest quality for the all-important service of transmitting power to the driving wheels of tractors and trucks. Every link of the roller chain bears the L-B trademark and every foot of this product is backed by the guarantee of the Link-Belt Company. The booklet contains full size illustrations of the chains and rollers, also illustrations of prominent tractor and truck types using the chain drive.

Men in Service

Samuel Scovil to Represent Ordnance Department—W. R. Thompson Promoted—A. H. Ferrandan Receives Commission

ELMOND H. LILES, general manager of the Merchants Telephone Company, Middlesex, N. C., has joined the Aviation Corps of the United States Navy.

B. J. ARNOLD, president of the Arnold Company, Chicago, has been commissioned a lieutenant-colonel in the Signal Corps of the United States Army and expects to be engaged in active service in France in a very short time.

C. MCKEW PARR, general sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn., left the concern on February 15 under an indefinite leave of absence to serve the War Trade Board at Washington as a volunteer worker.

T. W. CONNETTE, superintendent of transportation of city lines of the International Railway Company of Buffalo, recently received a commission as first lieutenant in the Ordnance Department and will immediately take up this work of national service at Washington.

CHARLES R. UNDERHILL, chief electrical engineer of the Acme Wire Company, New Haven, Conn., recently received a commission as captain in the aviation section of the Signal Reserve Corps. He is the inventor of a number of signal and wireless-telegraph devices.

INSTITUTE OF ELECTRICAL ENGINEERS, of London and New York City, in the January issue of the Journal publishes its ninth list, showing the names of 96 of its members, both active and associate, who have received promotions, transfers, etc., in various branches of military service.

A. H. FERRANDAN, formerly engineer of the Rate and Statistical Department of the United Gas & Electric Engineering Corporation, New York, was recently commissioned a first lieutenant in the Ordnance Reserve Corps and was assigned to the Small Arms Division in the War Department at Washington, D. C.

A. B. BOYNTON, district manager of the Electric Machinery Company for New York and New England, was recently commissioned a captain in the Engineer Officers' Reserve Corps. He is a graduate in electrical engineering of Cornell University and has been engaged in engineering and sales work for the last twenty years.

W. R. THOMPSON, manager of engineering and construction of H. M. Byllesby & Company, Chicago, has been promoted from captain to major of the 109th Regiment of Engineers. In 1903 Mr. Thompson became associated with the British Westinghouse Electric & Manufacturing Company and specialized on power house design and heavy electrical construction. He was later connected with J. G. White Company and also served the public service commission of the first district of New York as assistant electrical engineer.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, Birmingham, Ala., has been presented with a service flag by its women employees in honor of the men who have gone out in the service of their country. The flag, which measures 5x7 feet, offers space for 209 stars and hangs behind the plate glass window on the 21st Street side of the Birmingham office.

ROY W. REYNOLDS, general manager of the Mesaba Railway, Virginia, Minn., was recently commissioned a captain in the army engineering corps and has been ordered to report at Fort Lee, Petersburg, Va. He was formerly connected with the Hartford & Springfield Street Railway, Warehouse Point, Conn., as superintendent and was also connected with the Springfield (Mass.) Street Railway.

SAMUEL SCOVIL, who has just resigned as president of the Cleveland Electric Illuminating Company, will represent the United States ordnance department in the Cleveland district in co-ordinating the work of local industries. Several thousand factories in the greater part of Ohio and three western Pennsylvania counties will be consolidated into one organization with every part co-ordinated in turning out war material, under plans adopted by the Cleveland war industries commission. Questionnaires will be sent to all the manufacturers. The commission will thus know the number of machines in each plant, those engaged in war orders and the complete available production capacity. The government can be told quickly what labor conditions are in each plant and will be able to place orders where there is sufficient equipment to turn out finished products quickly. Blue prints of plans and specifications of government contracts will be on file in the offices of the commission. All industries are expected to be represented.

E. T. ROWLAND of the Continental Gas & Electric Company, Omaha, Neb., has joined the 37th Engineers stationed at Ft. Myer, Va.

HENRY W. HODGE, former Public Service Commissioner of the first district of the State of New York, now serving with General Pershing in France, has been promoted to the rank of lieutenant-colonel.

B. J. CALDWELL, vice-president of the Caldwell Electric Corporation, Champaign, Ill., was recently commissioned by the navy board to do electrical engineering for the navy. Mr. Caldwell is a graduate of the 1911 class of the college of engineering of the University of Illinois and has since been electrician for the Caldwell company.

E. M. SLEMMONS, salesman for the Ohio States Telephone Company, Columbus, Ohio, has been appointed for entrance into the officers' training camp at Camp Hancock, Augusta, Ga. He has had 13 years' experience in military activities, having enlisted in the Fourth Ohio Volunteer regiment at the outbreak of the Spanish-American war. At the close of the war he was elected captain of Company C, Fourth Ohio, now the 166th U. S. Infantry, from which he retired in 1910. His brother, Lieut. A. O. Slemmons, is now in the service at American Lake, Wash. An uncle, Capt. John P. Slemmons, was one of the organizers of the national guard during the Civil war and later became assistant adjutant general of Ohio.

UNITED GAS & ELECTRIC ENGINEERING CORPORATION, 61 Broadway, New York City, devotes several pages of the February Bulletin to its Roll of Honor, which contains the names of 427 men who have been called to the colors. The enlistments of employees from the affiliated companies of the United Gas & Electric Corporation are as follows: Birmingham Railway, Light & Power Company, 98; Union Gas & Electric Company, 2; International Railway Company, 67; Colorado Springs Light, Heat & Power Company, 5; Elmira Water, Light & Railroad Company, 14; Harrisburg Light & Power Company, 16; Houston Lighting & Power Company, 18; Houston Gas & Fuel Company, 12; Knoxville Railway & Light Company, 9; Conestoga Traction Company, 23; Edison Electric Company (Lancaster, Pa.), 7; Lancaster Gas Light & Fuel Company, 5; Little Rock Railway & Electric Company, 23; Leavenworth Light, Heat & Power Company, 1; Lockport Light, Heat & Power Company, 1; Memphis Street Railway Company, 52; Consumers Electric Light & Power Company, 8; New Orleans Gas Light Company, 4; New Orleans Railway & Light Company, 45; United Gas & Electric Engineering Corporation (New York), 5; Richmond Light, Heat & Power Company, 1; Citizens Gas & Fuel Company, 2; Wilkes-Barre Company, 7.

Personal

M. V. Stagg Joins F. Bissell Company—H. W. Fuller Vice President Northern States Power—Other Changes Made

J. A. PERKINS, formerly manager of the rate and statistical department of the United Gas & Electric Engineering Corporation, New York, has been elected vice-president of the organization. Mr. Perkins assumed his new office on January 10, and will continue to direct the rate and statistical affairs of the corporation.

M. V. STAGG, formerly connected with the Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind., has become manager of the appliance sales department of the F. Bissell Company, jobbers and manufacturers of electrical supplies and machinery, Toledo, Ohio.

Z. STARR COHEN, who for some time has been connected with the Northern New York Utilities, Inc., at Watertown, was recently appointed manager of the Wetmore Electric Company, Lowville, N. Y., a subsidiary of the above concern, succeeding George R. Dorsey, resigned.

H. B. SEWELL, formerly general superintendent of Houston Electric Company at Houston, Texas, has been made manager of the Puget Sound Traction, Light & Power Company and the Pacific Northwest Traction Company at Bellingham, Wash. He has arrived and taken charge of the affairs of the two companies.

C. C. CURTIS, lighting superintendent of the El Paso Electric Company, El Paso, Tex., will assume the duties of manager of the Cape Breton Electric Company, Ltd., operating the electric railway and lighting properties at Sydney, N. S. He succeeds E. L. Milliken, who goes to Houghton, Mich., as manager of the Houghton County Traction Company, in place of W. L. Weston, now first lieutenant in the United States Infantry. The El Paso, Cape Breton and Houghton properties are all controlled by Stone & Webster.

H. W. FULLER has been appointed vice-president in charge of operation of the Northern States Power Company, Minneapolis, Minn., a subsidiary of H. M. Byllesby & Company. In this capacity Mr. Fuller will relieve R. F. Pack, vice-president and general manager, of operating responsibilities which have increased greatly due to the rapid growth of the Northern States organization. Mr. Fuller has been associated with Byllesby & Company for seven years, devoting a large part of his time to the solution of special operating problems. He was born in New York and received his education in the public schools of Bayonne, N. J., the State Model School of New Jersey, and Rutger's College, and was graduated from that institution in 1891. He entered the service of the Consolidated Traction Company of Newark and became assistant superintendent and assistant general manager, leaving this position in 1901 to become manager of the Washington Railway & Electric Company.

W. R. KENNEDY has been appointed purchasing agent of the Fort Smith Light & Traction Company, Fort Smith, Ark., succeeding W. J. Parker.

P. T. PHILIPS has been appointed general superintendent of both the Electric and Heat Departments of the Little Rock Railway & Electric Company and will have full authority over power house operation. This appointment is incidental to the merging of the heating business with the other departments.

H. W. DEININGER has resigned as manager of the Sac City district for the Iowa Light, Heat & Power Company to become general superintendent of the Iowa Southern Utilities Company, with headquarters at Centerville, Iowa. Mr. Deininger was for several years vice-president and general manager of the Sac City Electric Company.

F. W. WEBSTER, formerly special agent of the Southern Bell Telephone & Telegraph Company, Atlanta, Ga., has been appointed general manager of the Gainesboro Telephone & Telegraph Company, succeeding L. K. Smith, who recently resigned to engage in other enterprises. Mr. Webster entered the service of the Southern Bell company twelve years ago and has been special agent in the office of the general contract agent.

I. L. WARD, who was formerly connected with the Southern Pacific Company in San Francisco, has been appointed purchasing agent for the Pacific Electric Railway, Los Angeles, Cal. He succeeds F. W. Taylor, who left the company to become purchasing agent of the Southern Pacific System in the territory from El Paso to Portland. For the last eight years Mr. Ward has been connected with the Southern Pacific, advancing steadily until he became chief clerk of the purchasing department. Through this new position he becomes practically the largest purchaser of materials in southern California.

E. W. LIBBEY was recently appointed chief clerk of the Department of Commerce by Secretary Reffield to succeed Dr. George C. Havenne, resigned, and the appointment is one where merit and efficiency has brought its inevitable result. He was born in New Hampshire, was educated in the schools of Washington, and gained his first experience in the employ of the Western Union Telegraph Company as a messenger boy. During his spare moments he studied telegraphy and finally became an expert operator, being for some time stationed at the Capitol. Mr. Libbey was first appointed in the then Department of Commerce and Labor in July, 1903, at the time of its creation as a telegraph operator, and was gradually and steadily promoted until he became assistant chief clerk of the department. Mr. Libbey is well known in Washington, and his host of friends will rejoice in the good fortune which has come to him.

FRANCIS L. GILMAN, assistant chief engineer of the Western Electric Company, New York, has resigned to take charge of the manufacturing departments of the National Conduit & Cable Company, West Brookfield, Mass.

O. A. SMITH, who for the last nine years has been connected with the Pacific Electric Railways, Los Angeles, Cal., has been promoted to the position of general passenger agent, and succeeds in part to the duties previously performed by D. W. Pontius.

F. A. WILLIAMSON, of the New York Telephone Company, tendered an address entitled, "The Telephone in the World War," before the Men's Club of St. Paul's M. E. Church, Third street, Jersey City, N. J., on February 9. The address consisted of a number of vivid telephone incidents, gathered from the various battle fronts, and illustrated by about ninety authentic photographs. The lecture was concluded with an account of the war-time use of the telephone in the United States, and by actual views of the telephone work of American troops in training here and in service in France.

SAMUEL SCOVIL, for many years president of the Cleveland Electric Illuminating Company, Cleveland, O., has resigned his position to devote all of his time to war work. For some time past he has been the representative in the Cleveland district for the Federal ordnance department and the duties of this office have gradually become more extensive. Mr. Scovil has been a prominent figure in the central-station field and was active in the National Electric Light Association, the Ohio Electric Light Association and other similar organizations. He will be succeeded by Harrison Williams, formerly chairman of the Board of Directors. Robert Lindsay, vice-president and general manager, remains in that capacity and will have active charge of the company.

F. W. SMITH, vice-president of the United Electric Light & Power Company, was recently appointed chairman of the Gas and Electric Light, Heat and Power Group of the National War-Savings Committee and is rendering valuable service in promoting the War-Savings Campaign inaugurated by the United States Treasury Department. Through the efforts of Mr. Smith attractive posters have been produced and distributed and arrangements for the distribution of literature are also being made by him. In a further effort to assist the campaign, literature urging the purchase of the thrift stamps will be sent with the monthly gas and electric bills to 1,800,000 consumers. Twenty-seven public service companies in all the boroughs of New York have become authorized agents for the Treasury Department and sales stations for Thrift and War Savings Stamps will be opened at the 70 branches of these companies throughout the Greater City.

Recent Patents

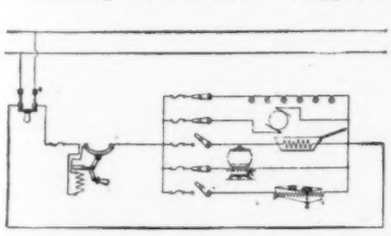
Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Electric Soldering Iron (1,250,856).—To expedite the repairing or replacing of the heating unit in a soldering or branding iron, James T. Griffin (of Oak Park, Ill., in a patent assigned to the Western Electric Co.) uses an inexpensive heating unit which can readily be removed by unscrewing part of a simple casing.

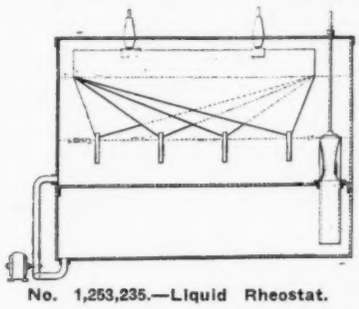
Electrically Propelled Vehicle (1,250,231).—That trackless-trolley systems may be among the developments of electric traction in this country, is implied by the recent patent assigned by Theo. H. Schoepf, of Pittsburgh, to the Westinghouse Electric & Mfg. Co. For this purpose, Mr. Schoepf proposes to provide the needed propulsion through a dynamotor having half-units which are connected in series when the vehicle is run from the trolley circuit. Then he provides means for connecting a storage battery to one of these half-units for driving the vehicle as a battery car, and for charging the battery from a shunt around one of the half-units while the vehicle is running on the trolley current, so as to keep the battery continuously charged during the normal operation of the car.

Household Load-Limiting Switch (1,250,536).—To aid central stations in avoiding peak loads, while also stimulating the customers to approximate their maximum demand as continuously as possible, William L. Waters, of Milwaukee, has improved on the old plan of entirely rupturing the circuit in case of an overload. Instead, he provides interlocking switches so arranged that only the excessive part of the load will be automatically disconnected, and that the least important part of the load will be disconnected first. In this way, heat-storage stoves, heaters for hot-water systems, or the like, could readily be supplied with current when the remainder of the demand is low, thereby helping to level the load curve and warranting a lower rate.



No. 1,250,536.—Load-Limiting Switch.

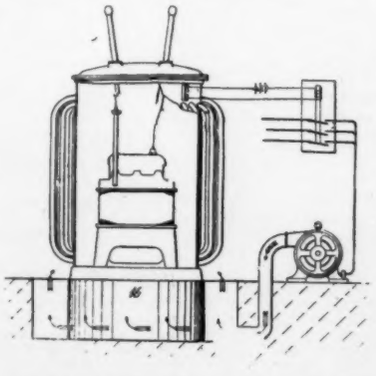
Liquid Rheostat (1,253,235).—To change the effective resistance of a liquid more rapidly by varying the height of the liquid, Arthur J. Hall gives each plate a triangular lower portion and spaces the tips of the triangle from each other. The patent stands assigned to the Westinghouse Electric & Mfg. Co.



No. 1,253,235.—Liquid Rheostat.

Making Steel Electrically (1,252,443).—For this purpose, Ernest Humbert (of Welland, Ontario) introduces a substantially complete charge into an electric furnace in the form of solids containing the iron and an excess of carbon. Then he strikes an arc from an electrode to the solid material of the charge, melts the latter by the resulting heat, and introduces air to lower the carbon content to the desired percentage.

Cooling a Transformer Casing (1,254,002).—Instead of depending entirely on wind or other natural air circulation for cooling the heat-radiating portions of a transformer casing, Charles S. Cook, of Pittsburgh, and Harold H. Rudd, of Edgewood, Pa., cool these portions by an air blast. This blast is supplied by a motor-driven blower, which in turn is controlled by a thermostat so as to operate only when the temperature of the casing exceeds a certain value. The patent is assigned to the Westinghouse Electric & Mfg. Co.

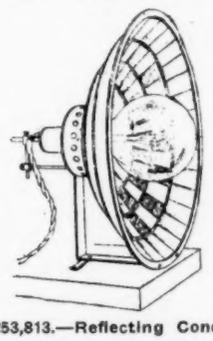


No. 1,254,002.—Intensive Cooling of Transformer.

Insulating Material (1,252,468).—In making insulating material in the form of boards, Helon B. MacFarland, of Chicago, and Robert J. Schoemaker, of Topeka, Kans., use pulped cellulose as a binder for a mixture consisting of a fibrous material and a binder.

Illuminometer (1,252,598).—A compact device for comparing the illumination of a test surface from an outside source with that afforded by a standard lamp within the instrument. Patent assigned by Norman Macbeth, of New York, and Irving B. Smith, of Ambler, Pa., to The Leeds & Northrup Co., Philadelphia.

Reflecting Condenser (1,253,813).—To concentrate the light of a single lamp when using this for enlarging photographs or the like, Robert D. Gray, of Ridgewood, N. J., mounts mirror reflector panels in concentric rows on the interior of a bowl-shaped reflector. These panels are so proportioned that the outermost and innermost rows have a reflecting power exceeding the intermediate row of panels, and the mirrors of each intermediate reflecting row are alternately of high and low reflecting power.



No. 1,253,813.—Reflecting Condenser.

Welding and Annealing Steel (1,252,746).—For this purpose, Edmund J. von Henke (of Lynn, Mass.) forms a butt weld, then opens the clamps and immediately thereafter passes electric current through the steel back of the clamped section so as to bring this to the desired annealing temperature. The arrangement is said to be particularly adapted to the making of high-speed tools, and the patent was assigned to the Thompson Electric Welding Co.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

BOOTHBAY HARBOR, ME.—Lincoln County Power Company has taken over the Boothbay Harbor Electric Light & Power Company and plans to enlarge the plant and increase the production of electricity. Contracts have been awarded for the construction of a new power station at Boothbay Harbor, and work is being pushed on the new transmission line to connect Damariscotta, Bristol and Boothbay Harbor. Power will be carried from Bristol Mills to Damariscotta and Boothbay Harbor over 11,000 volt lines, which are being erected in acordance with the best modern practice.

BROOKLYN, N. Y.—Krantz Manufacturing Company, Seventh Street, near Second Avenue, has awarded a contract to the Werner-Huberty Company, 50 Court Street, Brooklyn, for the construction of an addition to its four-story plant. The new structure is estimated to cost $35,000. The company engages in the manufacture of electrical goods.

AUBURN, N. Y.—The New York Telephone Company, 15 Dey Street, New York, has had plans prepared for the construction of a telephone exchange plant on South Street, Auburn. The building will be of brick construction.

NEW YORK, N. Y.—The Brooklyn Rapid Transit Company will expend a sum in excess of $3,000,000 for the purchase of 100 large rapid transit cars, of the type used in the new subways, and 50 large surface cars to be used in two-car trains on the busiest surface lines.

CLOSTER, N. J.—Permission has been granted by the Board of Public Utility Commissioners to the Rockland Electric Company for the issuance of securities to the amount of $80,000 for improvements and extensions.

DOVER, N. J.—New Jersey Power & Light Company has been awarded a contract for supplying electric power to the amount of 60 horsepower for the operation of the plant of the Somerset Stone Crushing Company, Bernardsville, replacing the steam motive power heretofore used.

NEWARK, N. J.—The coal situation in this section and the entire Northe section of New Jersey has grown steadily worse, and on February 12, at 4 p. m., the Public Service Electric Company was compelled to suspend all power operations until further notice, applying to all industrial plants, many of which were engaged in war work. It is expected that this order will be in effect for at least one week. Many thousands of employes of the various plants have been thrown out of employment. Among the more important concerns engaged on Government contracts which are affected by the power shut-down are: General Electric Company, Harrison; Thomas A. Edison Company, West Orange; Electro-Dynamic Company, Bayonne; Carbo-Hydrogen Company, Bayonne.

NEWTON, N. J.—The Town Committee is considering improvements in its fire alarm system.

POMPTON LAKES, N. J.—The Board of Education is considering the immediate installation of new electric lighting systems throughout its school buildings.

TRENTON, N. J.—Until February 26, bids will be received by the State Architect for the installation of a refrigerating plant at the New Jersey State Hospital, Morris Plains. Francis H. Bent, State Architect.

TRENTON, N. J.—The City Commission is having plans prepared for the construction of a power plant in connection with the erection of the first unit of the general hospital, to be located at the Municipal Colony. The structure is estimated to cost about $15,000. William A. Klemann, Trenton, is architect.

WEST NEW YORK, N. J.—The Town Council is considering the issuance of bonds to the amount of $150,000 to provide for the construction of a municipal electric lighting plant.

HAZLETON, PA.—The accounting and engineering departments of the Harwood Electric and the Lehigh Navigation Electric Companies will be transferred to Allentown in April. The Harwood and Lehigh concerns are part of the big merger of electric and power companies of eastern Pennsylvania, whose headquarters are located at the Lehigh county seat.

BIRDSBORO, PA.—Birdsboro Electric Company has commenced the construction of a high-tension power line to the mines at French Creek to supply power for the operation of the Brooke Iron Company.

CARLISLE, PA.—City Council is considering extensive improvements in its fire alarm system.

GROVE CITY, PA.—Grove City Creamery Company has awarded a contract for the construction of its proposed power plant, which will be erected in connection with a three-story plant. The work is estimated to cost $35,000. Rose & Fisher, 1719 Pennsylvania Avenue, Pittsburgh, are the contractors.

PHILADELPHIA, PA.—Counties Gas & Electric Company has recently been awarded a contract for supplying service to the borough of Trappe, Montgomery County, for the operation of its electric street-lighting system.

PHILADELPHIA, PA.—Tioga Steel Company is making rapid progress in the construction of a power house which is being erected in connection with a new forge shop and machine shop at Fifty-first Street and Grays Avenue. The entire work will cost about $70,000. Crowell, Lundoff, Little Company, Cleveland, Ohio, are the contractors.

PHILADELPHIA, PA.—At a recent meeting of the stockholders of the Philadelphia Rapid Transit Company, it was voted to authorize the board of directors to accept the lease of the projected high-speed city lines. Application for approval will be made to the Public Service Commission.

PHILADELPHIA, PA.—Shane Brothers & Wilson Company, Sixty-third and Market Streets, have awarded contract to F. B. Davis, Philadelphia, for the construction of its proposed one-story brick and concrete power house, about 35x45 feet in size.

PHILADELPHIA, PA.—L. S. Leberman is having plans prepared for the construction of a one-story brick and concrete power house at his plant in the Kensington district. The structure is estimated to cost $10,000. Andrew J. Sauer & Company, Philadelphia, architects.

PITTSBURGH, PA.—West Penn Power Company has filed notice with the Public Service Commission of the issuance of notes for $1,500,000 to provide for extensions and improvements in its plant and system.

DOVER, DEL.—Bell Telephone Company has had plans prepared for alterations and additions to its local telephone office building.

MONKTON, MD.—Monkton Roller Mills are planning for the construction of a hydroelectric plant for the operation of its flour mills. The structure is estimated to cost $25,000. In connection with this plant, a concrete dam and power house to generate about 100 horsepower will also be constructed, together with about one-quarter of a mile of transmission line.

WASHINGTON, D. C.—The Bureau of Standards, Department of Commerce, has authorized the construction of a four-story testing laboratory, about 165x350 feet in size. Contract for the new structure, which is estimated to cost about $750,000, has been awarded to the Turner Construction Company, New York.

TAZEWELL, VA.—Bluefield-Tazewell Telephone Company has filed notice of an increase in its capitalization from $250,000 to $300,000 to provide for expansion.

RALEIGH, N. C.—Empire Steel Company is considering the construction of a hydroelectric plant for the development of approximately 10,000 horsepower for the operation of its proposed steel plant.

MONTEZUMA, GA.—James Harrison and E. M. McKenzie are planning for the installation of a hydroelectric plant on Whitewater Creek, a distance of about four miles from Montezuma, for the generation of electric power for transmission to Montezuma and Oglethorpe for industrial and lighting purposes.

BONIFAY, FLA.—The City has recently acquired the local electric-light and water plant, and is planning for extensive improvements to cost about $21,000. The J. B. McCrary Company, Atlanta, Ga., contractor and engineer.

PENSACOLA, FLA.—Pensacola Electric Company is considering the construction of a 13,200-volt transmission line to the Pensacola Naval Station. Thomas J. Hanlon, Jr., is manager.

WAUCHULA, FLA.—The City is considering a bond issue for $42,000 to provide for the construction of an electric light plant.

NORTH CENTRAL STATES.

INDIANAPOLIS, IND.—Standard Machine & Electric Company has changed its name to the Marschke Manufacturing Company.

INDIANAPOLIS, IND.—The Indiana Public Service Commission has denied the petition of the Union City Telephone Company for an increase in its rates on the ground of increased cost of labor and materials because of the company paying dividends on common stock which does not represent property value.

INDIANAPOLIS, IND.—Indiana Public Service Commission has given permission to the bondholders of that part of the Gary & Interurban Railroad Company, connecting Gary and Valparaiso, to dismantle the physical property of the road and to dispose of the junk.

MONTICELLO, IND.—Northern Indiana Utilities Company has filed a final certificate of dissolution with the Indiana secretary of state.

AURORA, ILL.—City has passed a new lighting ordinance whereby lights in the residence district may burn from 5:30 a. m. until daylight and in the evening may burn until eleven o'clock.

CARLINVILLE, ILL.—The activity of the Standard Oil Company in bringing large numbers of miners to work in the new shafts in the vicinity of this city may result in the construction of an electric interurban railroad between Carlinville and Schoper, Ill.

CHICAGO, ILL.—The Suburban Railroad of Chicago and Emil G. Schmidt, its receiver, have filed a petition with the Illinois Public Utilities Commission to sell all its corporate property and assets to the Chicago & West Towns Railway Company.

KEWANEE, ILL.—The Illinois Public Utilities Commission has revised the new schedule of rates for Galva, Kewanee and vicinity filed with the Commisison by the Central Light & Power Company.

MATTOON, ILL.—An increase in the cost of light and heating service in

twenty-seven towns proposed by the Central Illinois Public Service Company has been postponed until June 17, 1918, until the Illinois Public Utilities Commission can make an examination in order to determine the reasonableness of the proposed advance.

MATTOON, ILL.—The Illinois Public Utilities Commission has given permission to the Central Illinois Public Service Company to issue $200,000 preferred capital stock and $150,000 in first and refunding mortgage gold bonds.

SPRINGFIELD, ILL.—Athens Electric Light Company has applied to the Illinois Public Utilities Commission for an increase in its rates at Athens, Ill. The Southern Illinois Light & Power Company has made a similar request to affect Marine and Coffeen, Ill.

BROOTEN, MINN.—The installation of a 25-horsepower oil engine and 15 kilowatt generator to take the place of storage battery in the electric light plant is under advisement. Address F. W. Sonenberg, superintendent.

GLENWOOD, MINN.—Glenwood Electric Light, Heat & Power Company plans the extension of its high tension transmission line to Cyrus. Address E. O. Burow, superintendent.

GLYNDON, MINN.—Glyndon Light Company is making arrangements to install additional street lamps.

HIBBING, MINN.—The city contemplates the construction of a municipal electric plant. G. L. Thauin, secretary of Water & Light Commission.

MILAN, MINN.—Milan Light & Power Company plans the installation of a storage battery in spring.

AMES, IOWA.—A 600-kilowatt generator and a 2200 volt 3-phase, 60-cycle turbine will be installed in the electric light and water plant. Address A. F. Hill, manager.

DANBURY, IOWA.—Durst Light & Power Company is considering the extension of its electric transmission lines towards Mapleton this summer. Address Mark Durst, manager.

EARLHAM, IOWA.—The city has the extension of its municipal electric transmission lines outside of the city limits, requiring poles, wire and transformers, under consideration. Address M. A. Thorp, superintendent.

EDDYVILLE, IOWA.—The question of issuing $8000 in bonds for rebuilding the municipal light plant will be submitted to vote. Address city clerk.

INDEPENDENCE, IA.—Electrical improvements are being planned for the Hospital for the Insane. F. S. Trost, secretary.

GALLATIN, MO.—An ornamental street lighting system will be installed here.

GREGORY LANDING, MO.—Gregory Drainage district is having plans prepared by E. T. Perkins Engineering Company, State Bank building, Quincy, Ill., for one-story brick pumping station to cost $75,000.

KANSAS CITY, MO.—Kansas City Light & Power Company has filed a petition with the Missouri Public Utilities Commission asking permission to increase the capital stock from $4,997,300 to $10,000,000.

META, MO.—Fritz Schallert is considering the installation of an electric light plant here.

OREGON, MO.—The city contemplates the construction of a transmission system from St. Joseph to secure electricity for the municipal electric light system. Address the mayor.

ROCK PORT, MO.—Tarkio Electric Light Company has bought an interest in the Rock Port Power plant.

ST. LOUIS, MO.—Union Electric Light & Power Company plans to issue $1,500,000 bonds and $1,000,000 additional stock. Address James D. Mortimer, president, 315 North 12th street.

KAHOKA, MO.—The City Council is considering improvements and extensions in its transmission system to Williamstown, Luray, Clark City, and Medill. L. R. Sherrill is superintendent.

OZARK, MO.—Finley Light Company will establish an electric plant to cost $15,000, and will use power from the hydroelectric line. Address George T. Breazeale, manager.

ABILENE, KANS.—Riverside Power, Light & Gas Company has increased its capital stock to $1,000,000. Jacob Brown is president of the company.

EMPORIA, KANS.—Western Union Telegraph office here is planning electrical improvements to cost $2500.

FORT SCOTT, KANS.—Fort Scott Gas & Electric Company, which owns the electric light, gas, steam heating and street car plants of this city is bankrupt, according to allegations in a receivership suit recently filed in the district court by the St. Louis Light Development Company. The company, which has been operating the plant under contract and which about two years ago reported to the State utility board, bought the Fort Scott utilities from the gas and electric company on January 31. Judge Kelso, chief counsel for the light and development company, who filed the receivership suit and Mr. Porter, one of the chief operating officers of the concern, were in conference with the company's officials and members of the Chamber of Commerce to determine whether or not it is possible to continue the operation of the plant without the cost incident to a receivership. Judge Kelso in speaking for the company said the company would be able to continue the operation of utilities with the exception of the street car plant if the city will permit it to charge rates high enough to meet the running expenses. If this is refused by the city, the company will allow the court to take the plants and operate them for the creditors.

GARDEN CITY, KANS.—Garden City Power Company has been chartered with $750,000 capital stock by J. P. Nolan, F. A. Gillespie and J. S. McCamba.

DATES AHEAD.

Illinois Electrical Contractors' Association. Semi-annual convention, Chicago, February 22-23, 1918. Secretary-Treasurer, L. B. Van Nuys, 238 South Jefferson Avenue, Peoria, Ill.

Vermont Electrical Association. Annual meeting February, 1918. Secretary-Treasurer, C. H. West, Rutland, Vt.

National Association of Electrical Inspectors. Annual convention, New York, March, 1918. Secretary-Treasurer, William L. Smith, Concord, Mass.

Wisconsin Electrical Association. Annual meeting, Pfister Hotel, Milwaukee, March 27-28, 1918. Secretary, George Allison, 1419 First National Bank Building, Milwaukee, Wis.

Tri-State Water & Light Association. Annual meeting. Charlotte, N. C., April, 1918. Secretary-Treasurer, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical & Gas Association. Annual convention, Galvez Hotel, Galveston, Tex., April 15-16. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

American Association of Engineers. Annual meeting, May 14, 1918. Secretary-Treasurer, A. H. Krom, 29 South La Salle Street, Chicago.

National Electrical Credit Association. Annual meeting, June 1, 1918. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, June 19-20, 1918. Atlanta, Ga. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

Northwest Electric Light & Power Association; affiliated with N. E. L. A. Annual meeting September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19, 1918. Secretary-Treasurer, W. W. Austin, Cottonwood Falls, Kans.

HUNTER, KAN.—The city is to have an ornamental street lighting system.

KINGMAN, KANS.—Independent Milling Company has bought the Kingman Light and Power Company.

LAWRENCE, KANS.—It will be necessary to build a central power house soon. J. D. Bowersock contemplates the building of a large boiler plant near New Hampshire Street to supply the power demanded by the city.

LEON, KANS.—Election will be called soon to vote bonds of $15,000 for electrical improvements. C. F. Palmer, clerk.

OTTAWA, KANS.—At a conference between interested citizens and the city commissioners recently it was agreed that the city will extend its electric light line on South Willow street from Eleventh to Fifteenth streets and then east on Fifteenth from Willow to Locust.

FALLS CITY, NEB.—Election carried recently to vote $60,000 bonds for electrical improvements and $15,000 for waterworks extensions. J. Mullen, clerk.

JUNIATA, NEB.—Election will be called in the near future to vote $7,000 in bonds to construct a transmission line to Hastings, Neb.

NOME, N. DAK.—The City Council has the installation of an electric lighting system under consideration.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—The breaking of a governor on one of the large engines at the riverside plant of the Louisville Gas & Electric Company, on February 12, caused the city to be practically without light or power for a period of thirty minutes, or until reserve engines could be placed in operation. However, the damage was slight, and was quick repaired.

LOUISVILLE, KY.—It is more than probable that the Louisville Water Company will become a much larger buyer of machinery and electrical equipment during the next four years as a result of the recent appointment of Sebastian Zorn as president of the company. Mr. Zorn was president of the company for four years, that being several years back, and started a number of reforms, including installing modern machinery and greatly increasing the capacity of the plant. Several big improvements were never carried out when his term expired.

MIDDLESBORO, KY.—A mass meeting of leading citizens, coal mine operators and capitalists was held here recently for the purpose of endeavoring to secure a street car system for the city, it being planned to extend the lines to the mines in order to carry the thousands of laborers in the district. J. M. Rogan was appointed chairman of a ways and means committee which will look after the matter.

WALTON, KY.—Walton Electric Light Company, of which E. L. Kelley is manager, will install an oil engine, directly connected to 250-volt direct current generator.

NORTONVILLE, KY.—Norton Coal Mining Company is planning for the construction of an addition to its power house, in connection with other structures at its plant. B. Price, Empire Building, Birmingham, Ala., is architect.

PADUCAH, KY.—Commissioner of Public Works, W. A. Gardner, has requested the City Commissioners to make a $40,000 appropriation for erection of an addition to the municipal lighting plant, installation of two 300 horsepower boilers, and the raising of the roof of the plant, which is now too low f convenient improvements. This proposition was referred to the committee which is making up the annual budget.

MEMPHIS, TENN.—Cumberland Electric Manufacturing Company, with a capital stock of $6000, has incorporated to manufacture electric supplies. The incorporators are M. W. Nelson, H. A. Beckham, E. L. Nelson, J. S. Nelson and William C. Burton.

NASHVILLE, TENN.—Welch Millar Company will purchase engines, dynamos and electric pumps for coal mining.

NASHVILLE, TENN.—Tennessee Power Company is contemplating additional water power electrical developments and transmission line extensions for furnish-

ing electricity to $60,000,000 explosive plant the Government will build at Hadley's Bend.

CLARKSDALE, MISS.—The Water & Light Commission is considering improvements in its power plant, including the installation of a 1000-kilowatt turbo-generator and 1000-horsepower water-tube boiler.

POPLARVILLE, MISS. — Poplarville Light & Water Company has leased the local electric light and water systems, and has commenced the installation of new equipment.

HELENA, ARK.—Helena Gas & Electric Company has filed notice of an increase in its capitalization from $300,000 to $500,000 for extensions, etc.

LITTLE ROCK, ARK.—The Little Rock Railway & Electric Company has awarded a contract for the installation of a turbine in its power plant to provide for increased capacity. Estimated cost, $200,000.

ROGERS, ARK.—The City Council has adopted a resolution favoring the purchase of the electric light and power plant by the city. Address manager.

WELCH, IA. — Planters' Telephone Company is planning for the immediate reconstruction of its exchange plant recently destroyed by fire.

BRISTOW, OKLA.—Election will be held March 12 to vote $36,000 in bonds for purchasing and improving the electric light system. T. B. Gibson, city clerk.

CANADIAN, OKLA.—Canadian contemplates voting bonds for the construction of a water and electric light system.

CHANDLER, OKLA.—Work will be started soon on power plant improvements, which include a power house 50x70 feet in size, one 150 horsepower boiler, one 150 horsepower Corliss engine, directly connected to 230 volt 3-phase, 60-cycle generator, pump, smoke stack, etc. Address Washita Electric Power Company, in care K. Johnston, Pauls Valley, Okla.

GUYMON, OKLA.—The town is planning the purchase of the Guymon Electric Light and Power Company.

KINGSTON, OKLA.—The electric light and gas plant has been destroyed by fire caused by an unknown explosion. Loss, $20,000.

MADILL, OKLA.—Consumers Light & Power Company has the erection of a new plant under consideration.

OKEMAH, OKLA.—The city contemplates voting on bonds for the improvement of the electric light plant, water works and sewer system. Address the mayor.

KINGSTON, OKLA.—Kingston Ice & Light Company is planning for the immediate reconstruction of its power plant recently destroyed by fire with loss estimated at $25,000. George Blethen is plant manager.

MIAMI, OKLA.—Empire District Electric Company of Oklahoma has filed notice of an increase in its capital from $30,000 to $200,000 for expansion.

PRAGUE, OKLA.—The City is planning for improvements and alterations in its electric lighting system.

AUSTIN, TEX.—The attorney general's department has approved an issue of $15,000 city of Bowie, Montague County, light plant bonds, bearing 5 per cent interest and maturing in forty years with an option of five years.

BALLINGER, TEX.—Interstate Electric Company is considering extensions in its transmission system. M. F. Treadwell is secretary.

BOWIE, TEX.—The power plant of the Texas Light & Power Company, which furnishes power and light for the city, was destroyed by fire recently with an estimated loss of $8000 with $3000 insurance.

DALLAS, TEX.—The board of city commissioners approved the application of the Dallas Power and Light Company to issue $2,000,000 notes and the application of the Dallas Street Railway Company to issue $1,000,000, the proceeds to be used from time to time in carrying forward improvements of these utilities. The notes are to be issued under the terms of the franchises.

PEARSALL, TEX.—Engineers have been here for several days making a map of the town for the Pearsall Water, Ice & Light Company, which will make some electrical improvements.

SABINAL, TEX.—Dr. W. T. Robinson of San Antonio has purchased the water works and electric light plants of the Sabinal Water and Light Company. He announces that the electric light plant will be equipped with new machinery and its capacity enlarged.

WACO, TEX.—Texas Electric Company has been granted a franchise by the city commission to construct and maintain a system of electric railway on a number of streets of the city.

WESTERN STATES.

LOVELAND, COLO. — City Engineer Eice has recommended the construction of a reinforced water stand pipe to cost $10,000.

SALT LAKE CITY, UTAH.—The city recorder has been authorized to advertise for bids for the installation of a special lighting system on Regent Street. Address city clerk.

SPOKANE, WASH.—Washington Water Power Company and the Stevens County Light & Power Company have closed a contract by which a power line approximately 40 miles long will be constructed to furnish power for the development of natural resources in the southern part of Stevens County. Power is to be taken from the Long Lake plant of the Washington Water Power Company. It is estimated that the demand for power within the next 18 months will amount to 3000 horsepower.

SPOKANE, WASH.—Washington Water Power Company has awarded a contract to the General Electric Company for the installation of a third generator at its Long Lake plant. The new generator has a capacity of 22,500 horsepower, which will increase the present capacity of the hydroelectric development by 50 per cent and will, with the two units installed, utilize about three-fourths of the water power available there. The cost of the generator with a bank of six transformers and a turbine is reported to be more than $250,000.

SEATTLE, WASH.—Plans have been practically completed by City Architect Daniel Huntington for the new Ballard substation to be erected at 14th avenue Northwest and West 49th street for Seattle. Plans call for a two-story and basement reinforced concrete structure 55x55 feet in size. The structure as contemplated will accommodate two motor generator sets. Date of calling for bids on construction of same not yet announced.

SPOKANE, WASH.—Plans for the Post Street curb lights to cost $37,740 have been adopted by the city council.

MARSHFIELD, ORE.—C. A. Smith Company electric plant is to be enlarged. Foundation and preliminary work have been completed for installing electrical equipment which will double the present output. Machinery for the second unit of the plant, costing about $80,000, is en route from Schenectady.

NEW PUBLICATIONS

ELECTRICAL GOODS IN ECUADOR AND PERU.—America's opportunity to increase its sales of electrical goods in Ecuador and Peru during the absence of German competition is pointed out in a report which has been made public by the Bureau of Foreign and Domestic Commerce. Before the war this trade was divided between Germany and the United States, the advantage being with the American manufacturer. The Government's report is concerned with the market as it exists today, and the opportunities it offers for the future. Copies of "Electrical Goods in Ecuador and Peru," Special Agents Series No. 154, may be purchased at the nominal price of 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from the district or co-operative offices of the Bureau of Foreign and Domestic Commerce.

COMBINED TABLE OF SIZES IN THE PRINCIPAL WIRE GAUGES (Circular 67), is a new publication issued by the Bureau of Standards, Department of Commerce. The booklet is in table form combining in one series the sizes in the American (B. & S.), Steel, Birmingham, (Stub's), British Standard, and Metric Wire Gages, arranged in order of diameters of wires. It contains the diameters of all the gage numbers in these five systems in mils, inches and millimeters, also the cross-sections in square mils, circular mils, square inches and square millmeters. The table is especially useful to manufacturers who wish to determine the nearest equivalent in American or British gage sizes of wires, specified in millimeters or square millimeters or vice versa. Those interested in this circular may obtain a copy by addressing a request to the Bureau.

TESTS OF OXYACETYLENE WELDED JOINTS IN STEEL PLATES.—Bulletin No. 98, issued by Engineering Experiment Station of the University of Illinois, is devoted to the Tests of Oxyacetylene Welded Joints in Steel Plates, in which the results of tests of strength of welds made under repair shop conditions and a detailed discussion of the technique of welding with the oxyacetylene blow torch are given. These tests were made on joints welded by skilled workmen in a shop especially fitted for oxyacetylene welding, and should not be considered as indicative of the strength of welds made in repair shops, or of welds made by workmen without special training in the use of the oxyacetylene torch. For joints made with no subsequent treatment after welding, the joint efficiency for static tension was found to be about 100 per cent for plates one-half inch in thickness or less, and to decrease for thicker plates. For static tension tests the efficiency of the material in the joints welded with no subsequent treatment is not greater than 75 per cent. The joints were strengthened by working the metal after welding and were weakened by annealing at 800° C. The results of the repeated stress tests give an index of the endurance qualities of the joints, and they follow in a general way the results of the static tests. For repeated stress tests the joint efficiency seems to be about 100 per cent for plates one-half inch or less in thickness, while the efficiency of material in the joint is somewhat less. It was found that hammering or drawing the weld while hot increases the strength and annealing from 800° C. lowers it. The impact tests show that oxyacetylene welded joints are decidedly weaker under shock than is the original material for joints welded with no subsequent treatment, the strength under impact seems to be about half that of the material. Data and numerous tables compiled by Herbert F. Moore are given, also typical diagrams of testing machines, etc., are contained in the bulletin.

PROPOSALS

HYDROELECTRIC PLANT.—Board of Public Works, Seattle, Wash., at a recent regular meeting, authorized the insertion in the call for bids of the statement that the City will pay sixty (60) per cent monthly of the value of the work done on the principal items entering into the power plant.

TRAVELING CRANE.—Sealed proposals will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until February 25, for one electric traveling crane of the overhead type installed on the runways in the addition to the boat shop at the navy yard, Philadelphia, Pa. Refer to Specifications No. 2809.

WIRE AND CABLE.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for 12,000 feet of interior communication, leaded and armored cable on Schedule 1685, for delivery at the Brooklyn (N. Y.) navy yard; 50,000 feet of lighting and power wire on Schedule 1682, and 5000 feet of lighting and power, two-conductor, leaded and armored wire, Schedule 1685, to be delivered at the navy yard at Puget Sound, Wash.

Financial News

Copper Production Can Meet All Demands.

The fixedness of copper prices under Government regulation undoubtedly has had the effect of increasing mining operations and imparting confidence to the copper-producing industry. With a steady price assured for a considerable period, all conditions relating to production have been fairly well adjusted to that basis. Also, the consumers of copper have had ample time to compute costs of manufacture in so far as the price of copper enters into them as a factor. Both producer and consumer are relieved of the uncertainty of fluctuating prices that formerly prevailed. Reports from some of the mining districts show that the January output exceeded that of any previous month for a year; and there is every indication that the demands for copper during 1918, for war munitions and general industries, will be fully met by the copper mining, smelting and refining companies. This applies to the requirements of England, France and Italy as well as those of the United States.

Copper Exports.

The following table shows the exports of copper from the United States by months since January, 1914, in tons of 2,240 pounds:

	1917.	1916.	1915.	1914.
Jan.	*51,322	23,663	26,193	36,018
Feb.	*32,265	20,648	15,583	34,634
March	*51,218	26,321	30,148	46,504
April	*49,536	21,654	18,738	35,079
May	*49,245	16,062	28,889	32,070
June	*41,177	39,595	16,976	35,182
July	*24,363	35,066	17,708	34,145
Aug.	*42,735	32,160	17,551	12,509
Sept.	28,952	29,403	14,327	19,402
Oct.	39,115	33,224	24,087	23,514
Nov.	38,638	22,598	23,168	24,999
Dec.		26,486	42,126	22,166
Total	448,596	327,310	276,344	360,229

*Exports to Canada included.

Philadelphia Electric Notes Offered.

An underwriting syndicate has placed an issue of short term 6 per cent notes of the Philadelphia Electric Company, Philadelphia, on a reported basis of 7¼ per cent. It is understood that the notes will run for two years and that the amount is approximately $6,500,000. The proceeds of the issue will finance construction at Chester, Eddystone and other capital requirements and retire $2,500,000 notes due next August.

Toledo Traction Light and Power Bonds Offered.

H. L. Doherty & Company are offering second lien 7 per cent convertible bonds of the Toledo Traction, Light & Power Company at 97 to yield 8¼ per cent. There are $1,200,000 of the bonds, due January 1, 1921.

Eastern Power Asks Exchange.

Eastern Power & Light Corporation announces that for the $2,327,500 5 per cent five-year convertible bonds of the company, which fall due on March 1, it offers in exchange par for par 7 per cent collateral trust notes, dated March 1, 1918, due September 1, 1918. The notes are to be secured by an equal amount of the maturing bonds when deposited by the present bondholders in exchange for the proposed new notes. Owing to the large additions and extensions that have been made to take care of increased business, the company has borrowed over $900,000 from banks. The company contemplated issuing and selling new securities to pay off both its bonds and bank loans. This has been made impossible by current financial conditions.

Water Power Company Files Financial Statement.

The annual meeting of the Washington Water Power Company was held at Spokane on February 4, when the company presented its annual statement, giving operating statistics for the past year. The number of customers increased from 32,067 in 1916 to 34,146 in 1917. During the year $397,443 was expended for distribution system and equipment in the light and power department and $26,565 for buildings, fixtures and ground. The street railway system spent $32,407 for road and structures. There was an increase of about 1,700,000 passengers carried on the street railway in 1917 compared with 1916, but there was not a similar increase in net earnings, due to large increases in wages. Mining activity in the Coeur d'Alenes in Idaho, caused a heavy increase in business in that section, the principal feature being the smelter of the Bunker Hill & Sullivan Mining & Concentrating Company at Kellogg, which began operating July of last year. The company sold and installed 945 electric ranges and 390 electric water heaters for domestic use during 1917. The net earnings for the year were $636,041.02. Total assets are $28,233,545.55.

Kansas City Light & Power to Increase Capital.

Kansas City Light & Power Company has made application to the Missouri Public Service Commission to increase its capital stock from $4,977,300 to $10,000,000.

Alabama Power Bonds Offered.

Alabama Power Company, through the Harris Trust & Savings Bank, of Chicago, is offering $1,000,000 first mortgage 5 per cent bonds, due March 1, 1946. The price is 85 and interest, yielding their investor 6.10 per cent. The Alabama Power Company serves directly and indirectly the larger part of Northern Alabama, including the Birmingham district.

Kentucky Utilities Bonds Offered.

The Woodruff Trust Company, Joliet, Ill., is offering a block of first mortgage 6 per cent gold bonds of the Kentucky Utilities Company, due October 15, 1919, the bonds being in denominations of $100, $500 and $1,000. They are secured by an absolute first mortgage on all property owned by the Kentucky Utilities Company and precede $1,270,000 worth of other bonds of the company, and $1,500,000 stock, which is owned by the Middle West Utilities Company.

Allis-Chalmers Profits Gain.

In the report of the Allis-Chalmers Manufacturing Company, covering three months ended December 31, 1917, net profits are given at $1,187,957, compared with $928,722 in 1916. Total sales billed in the three months amounted to $8,216,959, against $5,741,678 in 1916. Unfilled orders on hand December 31, 1917, totaled $26,935,146, against $13,424,486 in 1916.

The company's operations in the fourth quarter of 1917 resulted in the best showing of the year. Total sales billed showed an increase of $1,929,894, or 30 per cent over the third quarter, while net profits showed an increase of $268,553, or 29.2 per cent.

On the basis of the company's quarterly reports operations covering the last two years compare as follows:

	1917.	1916.
Total sales billed	$26,129,314	$19,440,509
Net profits	4,010,489	3,165,020

Dividends.

American Power & Light Company, New York, has declared its regular quarterly dividend of 1 per cent on common stock, payable March 1 to stockholders of record of February 19.

Southwestern Power & Light Company has declared its regular quarterly dividend of 1¾ per cent on preferred stock, payable March 1, to stockholders of record of February 19.

White Knob Copper & Development Company, Ltd., New York, has declared a dividend of 5 cents a share on preferred stock, payable February 25 to stockholders of record February 15.

Colorado Power Company has declared a quarterly dividend on preferred stock of 1¾ per cent, payable March 15 to stock of record February 28.

American Light & Power Company has declared a quarterly dividend of 1 per cent, payable March 1 to stock of record February 19.

Southwestern Power & Light Company has declared a quarterly dividend on preferred stock of 1¾ per cent, payable to stock of record February 19.

Eastern Wisconsin Electric Company has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable March 1 to stock of record February 20.

Banking Expansion.

The banking expansion which has taken place since the close of the year 1914 is indicated by the following condensed statement of the deposits, loans and holdings of United States and other securities of national banks at the dates given:

In thousands of dollars; 000 omitted.

	Dec. 31, 1914.	Nov. 10, 1915.	Nov. 17, 1916.	Nov. 20, 1917.
Deposits, net, on which reserve is computed.	$6,668,325	$8,256,662	$9,976,980	$10,348,806
Loans and discounts, including overdrafts.	6,363,435	7,241,140	8,355,101	9,550,571
United States bonds	791,995	777,765	724,473	†2,354,183
Other stocks, bonds and securities*	1,313,787	1,343,822	1,747,794	1,949,619

*Exclusive of Federal Reserve Bank stock.

†Includes United States certificates of indebtedness and payments on account of subscription for Liberty Loan bonds.

The principal items of the weekly statement of the Clearing House banks of New York are given below for the dates stated:

	Jan. 26, 1918.	Dec. 1, 1917.	Dec. 30, 1916.
Loans, investments, etc.	$4,113,882,000	$4,838,935,000	$3,339,450,000
Net demand deposits	3,666,713,000	3,465,325,000	3,334,272,000
Net Government deposits	243,546,000	931,155,000	*
Cash and reserves	690,318,000	723,703,000	691,842,000
Excess reserve	96,681,750	152,152,000	117,335,000

*Not reported in Clearing House statement.

The increase of loans and investments shown by these figures has been mainly due to holdings of Government securities, principally Treasury certificates.

The deposits, loans and discounts and cash resources of all banks of St. Paul and Minneapolis, for the dates stated, are given below, as an indication of banking conditions in that section of the country:

	Dec. 31, 1917.	Nov. 20, 1917.	Dec. 27, 1916.
Deposits	$308,084,000	$316,659,000	$245,342,000
Loans and discounts	198,063,000	204,340,000	185,575,000
Cash resources	94,079,000	83,159,000	72,829,000

Wisconsin-Minnesota Light & Power Company has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable March 1 to stock of record February 20.

Northern Ohio Electric Corporation has declared the regular quarterly dividend of 1½ per cent on preferred stock, payable March 1 to stock of record February 19.

Electric Investment Corporation has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable February 21 to stock of record February 11.

Kings County Electric Light & Power Company, Brooklyn, N. Y., has declared a quarterly dividend of $2 per share on the amount of the capital stock outstanding, payable March 1 to stockholders of record February 15.

Nebraska Power Company has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable March 1 to stock of record February 19.

General Electric Company has declared a quarterly dividend of $2 per share, payable April 15 to stock of record March 9.

Iron Cap Copper Company has declared a dividend of 25 cents per share, payable March 1 to stock of record February 21.

Calumet & Hecla Mining Company has declared a quarterly dividend of $10 a share, payable March 20 to stock of record February 21. This is the same amount as that declared three months ago. Six months ago a distribution of $25 was ordered.

Cerro de Pasco Copper Company has declared the usual quarterly dividend of $1 a share and an extra dividend of 25 cents a share, both payable March 1 to stock of record February 22. An extra dividend of the same amount was declared three months ago.

Copper Range Company has declared the regular quarterly dividend of $1.50 a share, payable March 15 to stock of record February 28. The usual extra of $1, which was declared each quarter last year, was omitted.

Earnings.

An analysis of earnings and expenses of the Columbia Gas & Electric System, prepared by A. B. Leach & Company, Inc., shows that during 1917 interest on the first mortgage 5s was earned 6.22 times, as against 3.43 times in 1916; 2.06 in 1915; 2.06 in 1914; 1.62 in 1913, and 1.04 in 1912. Interest on debenture bonds and miscellaneous interest was earned 23.45 times, as against 8.54 times in 1916; 3.31 in 1915; 3.46 in 1914; 3.41 in 1913. Per cent earned on capital stock in 1917 was 5.868, against 2.35 per cent in 1916; .761 per cent in 1915; .782 per cent in 1914, and .438 per cent in 1913.

The Public Service Corporation of Northern Illinois for the year ended December 31, 1917, reports a gain in net earnings, despite the higher cost of labor and materials. President Samuel Insull has prepared a statement of estimated income for last year which compares as follows with that for 1916:

	1917.	1916.
Gross earnings	$8,840,332	$7,783,157
Net after taxes	3,342,967	3,274,674

The balance available for dividends was somewhat smaller than in 1916, owing to an increase in interest charges. The interest charges in 1917 amounted to $1,614,867, against $1,497,818 in 1916.

National Conduit & Cable Company's net profits for the nine months ended December 31, 1917, after all expenses and charges, were $692,539, equal to $2.77 a share on the 250,000 shares of capital stock outstanding, which have no par value. Gross sales were $20,318,538 and total income $1,318,113.

UNITED GAS & ELECTRIC COMPANY.

The income account of the parent company for the year ended November 29, 1917, follows: Total income, $1,400,190; interest charges, $630,066; amortization of debt discount, $54,500; first preferred dividends, $649,936; surplus, $65,688.

CLEVELAND ELECTRIC ILLUMINATING COMPANY.

The Cleveland Electric Illuminating Company reports for December:

	1917.	1916.
Gross earnings	$ 774,597	$ 546,571
Net earnings	236,154	137,535
Gross income	251,021	143,827
Bal. after int. and dep.	115,809	47,347

For 12 months ended December 31:

Gross earnings	$6,863,886	$5,109,737
Net earnings	2,023,661	2,110,534
Gross income	2,063,624	2,126,684
Bal after int. and dep.	881,730	1,151,609

AMERICAN CITIES COMPANY.

For the twelve months to November 30 (subsidiary operating companies)—Gross, $16,583,375, increase $1,235,939; net after taxes, maintenance, etc., $5,571,806, increase $128,650; interest and rentals, $3,765,547, increase $84,319; amortization, $113,831, decrease $13,424; preferred dividends, $875,240, decrease $2,255; surplus, $817,188, increase $60,010.

The Keystone Telephone Company, Philadelphia, Pa., reports gross earnings for January of $136,519, against $127,531 for last year, and surplus earnings of $29,259, compared with $31,980 for the corresponding period of last year.

WESTERN POWER CORPORATION.

For the year ended December 31—Gross, $4,008,553; net after taxes, $2,515,828; other income debit, $24,973; interest charges, $1,678,158; California Electric Generating Company preferred dividends, $150,000; surplus, $662,697.

LOWELL ELECTRIC LIGHT CORPORATION.

	1917.	1916.
December gross	$ 71,507	$ 62,910
Net	33,996	27,491
Surplus after charges.	32,624	26,734
Twelve months' gross.	723,632	644,640
Net	284,522	259,471
Surplus after charges.	273,796	254,524

COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY.

The balance sheet of the Commonwealth Power, Railway & Light Company, as of December 31, 1917, compares with previous years as follows:

Assets.	1917.	1916.	1915.
Securities and property	$44,139,187	$42,608,367	$40,148,634
Guaranties	3	2	2
Cash	577,863	853,655	738,309
Advances to subsidiary companies	5,718,804	4,854,662	7,951,615
Accounts received from subsidiary cos.	538,783	370,773	176,004
Interest received from subsidiary cos.	12,381	13,371	15,721
Debt discount	9,660	38,592	67,524
Total	$50,996,681	$48,739,422	$49,097,809
Liabilities.			
Preferred stock	$17,953,000	$17,919,000	$16,000,000
Common stock	18,585,900	18,575,700	18,000,000
Common stock delivered	2,414,100	2,424,300	3,000,000
Bonds	8,047,000	8,081,000	10,000,000
Loans payable	2,407,500	350,000	350,000
Guaranties	3	2	2
Accrued accounts	285,474	152,233	188,222
Surplus	*1,303,703	1,237,188	934,584
Total	$50,996,681	$48,739,422	$49,097,807

*Of the amounts standing to credit of surplus accounts of subsidiary companies there are accruing to the Commonwealth Power, Railway & Light Company to December 31, 1917, undistributed earnings amounting to the sum of $3,301,701.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid. Feb. 12.	Bid. Feb. 19.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	14½	14
Adirondack Electric Power of Glens Falls, preferred	6	71½	72
American Gas & Electric of New York, common	10+extra	88	88
American Gas & Electric of New York, preferred	6	40½	40
American Light & Traction of New York, common	..	215	215
American Light & Traction of New York, preferred	6	94	95
American Power & Light of New York, common	4	43	43
American Power & Light of New York, preferred	6	72½	73
American Public Utilities of Grand Rapids, common	..	20	20
American Public Utilities of Grand Rapids, preferred	6	54	54
American Telephone & Telegraph of New York	..	106½	107½
American Water Works & Elec. of New York, common	..	4¾	4½
American Water Works & Elec. of New York, particip	7	9	9
American Water Works & Elec. of New York, first preferred	..	60	60
Appalachian Power of Bluefield, common	..	2¼	2¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	209	205
Cities Service of New York, preferred	6	74	74
Commonwealth Edison of Chicago	8	107	107
Comm. Power, Railway & Light of Jackson, common	..	20	21½
Comm. Power, Railway & Light of Jackson, preferred	6	50	50
Federal Light & Traction of New York, common	..	..	5
Federal Light & Traction of New York, preferred	..	..	28
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	60	59
Northern States Power of Chicago, common	ex.div.7	61	61
Northern States Power of Chicago, preferred	ex.div.7	87	87
Pacific Gas & Electric of San Francisco, common	..	33½	33
Pacific Gas & Electric of San Francisco, preferred	6	81	81
Public Service of Northern Illinois, Chicago, common	7	72	73
Public Service of Northern Illinois, Chicago, preferred	6	88	85
Republic Railway & Light of Youngstown, common	4	23¼	23¾
Republic Railway & Light of Youngstown, preferred	6	56	56
Standard Gas & Electric of Chicago, common	..	6	6
Standard Gas & Electric of Chicago, preferred	6	23	23
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	8
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	61½	61½
Western Power of San Francisco, common	..	11	11
Western Power of San Francisco, preferred	6	46	46
Western Union Telegraph of New York	extra	90½	89½
Industrials—			
Electric Storage of Philadelphia, common	4	49	49¾
General Electric of Schenectady	8	137½	137½
National Carbon of Cleveland, common	8	56¼	56¼
National Carbon of Cleveland, preferred	..	130⅔	130⅔
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	41¼	41¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	60	60

*Last sale.